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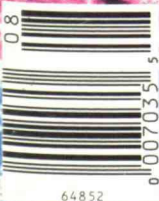
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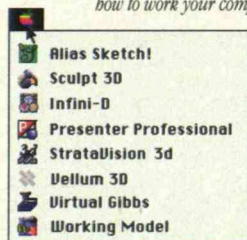
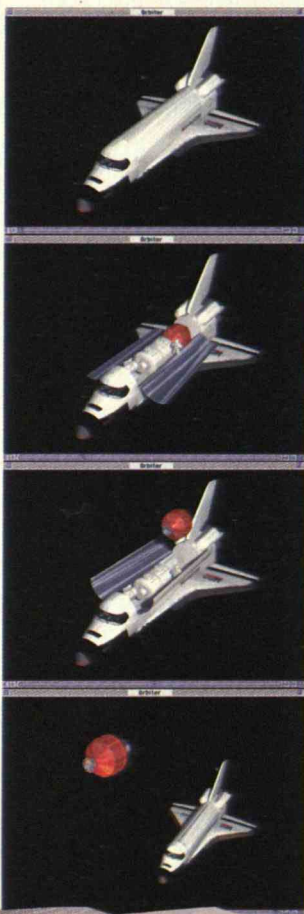
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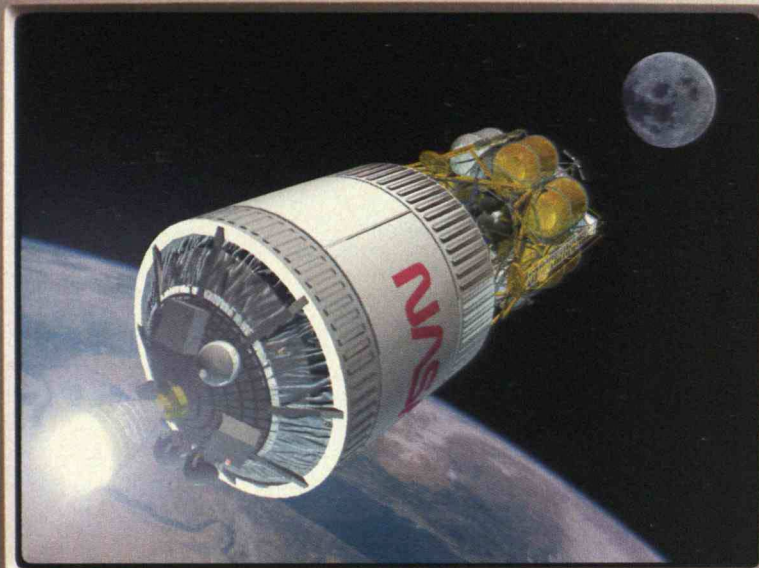
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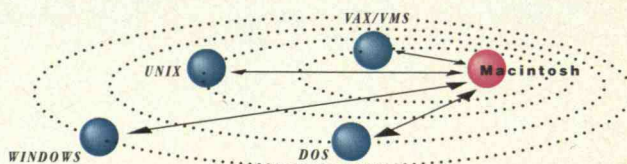
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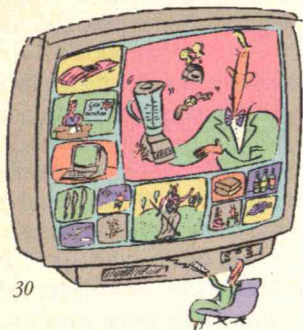


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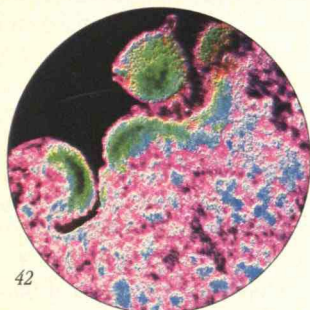


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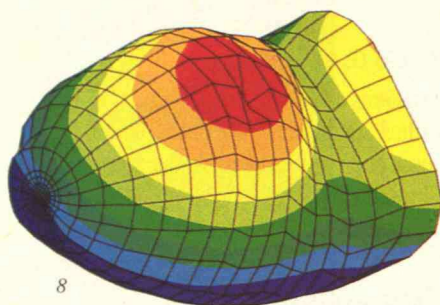


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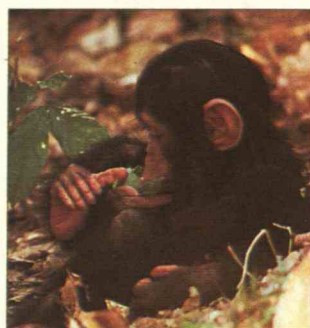
Cover: This HIV particle, budding from an infected cell, is ready to invade others. Research into such viral treachery is starting to unravel the mysteries of the human immune system.

PHOTO: CUSTOM MEDICAL STOCK/SPL

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First Line

Climbing Down From the Pedestal

WITH its heartstopping chases by dinosaurs who seem very much alive, hungry, and relentless, *Jurassic Park* is both terrifying and entertaining audiences across the country.

Some scientists are undoubtedly also feeling scared, though for different reasons, and not quite so amused, by either the film or the book, Michael Crichton's best-selling 1990 novel. Given *Jurassic Park*'s gross exaggerations of present scientific capabilities and the basic story's seemingly pervasive "anti-science" tone, researchers may understandably fear that their image could take another beating: moviegoers might look past the fantasy and artistic license to further condemn the same folks they see as having brought us *Challenger*, Chernobyl, and global warming.

Consider the following stupendous fictional breakthrough on which the plot of *Jurassic Park* depends: Working with DNA fragments derived from insects trapped in amber, biologists piece together enough of the genetic codes of dinosaurs (on whose blood the insects fed) to clone several species of the extinct colossi. These efforts, spearheaded by entrepreneur John Hammond, are not directed to some noble purpose. They are meant to make possible a theme park—Jurassic Park—that promises to be no less than "the greatest single tourist attraction in the history of the world."

The story's action takes place shortly before the scheduled grand opening, when several guests are given a tour of the premises. The park's staff of scientists, engineers, and technicians assure them that its numerous, state-of-the-art, and supposedly fail-safe features completely eliminate any danger. "We have everything under control," Hammond insists. "We've engineered the animals and engineered the resort." But the audience is soon poignantly reminded

that technological systems, and the people who design and operate them, are less than perfect. Nothing can supposedly go wrong, but just about everything does.

The resulting calamity is not just a fictional, unfortunate, and isolated accident, according to Crichton. "Ever since Newton and Descartes, science has explicitly offered us the vision of total control," mathematician Ian Malcolm (Crichton's apparent voice in the story) maintains. "But in the twentieth cen-

*Scientists are fair game
for storytelling and public
criticism because they are
fallible players in a true-life,
all-too-human drama.*

tury, that claim has been shattered beyond repair" because the would-be controllers have reached their limits. Scientists and engineers "don't have intelligence," claims Malcolm. "They have what I call 'thintelligence.' They see the immediate situation [but] they don't see the consequences."

As the plot of *Jurassic Park* makes abundantly clear, Crichton is especially concerned about the risks of biotechnology. But in case anyone misses the point, he says so directly. Not only is the biotechnology revolution ubiquitous (with research conducted in thousands of facilities, mostly private, throughout the world), often directed toward frivolous ends, and largely without the ameliorating influence of coherent government policy, he asserts. "Most disturbing is that no watchdogs are found among scientists themselves. It is remarkable that nearly every scientist in genetics research is also engaged in the commerce of biotechnology. There are no detached observers. Everybody has a stake."

The film actually deals lightly with such concepts—and most others—to

emphasize special effects: the lifelike dinosaurs are indeed an awesome tour de force of high-tech puppetry and computer animation. But aside from recalling the Frankenstein myth, the film's scientific message (as opposed to the book's) doesn't amount to much. In fact, with little surviving message of any kind, *Jurassic Park* is basically a knee-jerk action movie. Worried scientists can therefore relax, unless film audiences go back and read the book—from which all of the above quotes are taken.

Crichton's depiction of science in the original *Jurassic Park* is unambiguous and harsh. But even there, his indictments should not be dismissed simply as "anti-science" any more than a movie critic's negative reviews should be regarded as anti-film. He is a storyteller (in fact trained as a physician) giving creative expression to what he sees as worrisome trends in a dramatic, potentially harmful, but correctable enterprise.

Scientists may find it difficult to accept some artistic distortion in their fictional characterizations, and even abide public criticisms of their *actual* endeavors, because they have for so long been regarded as saints—as benefactors who selflessly work miracles for the masses—rather than as competent but ordinary people who come complete with human frailties. Thus like any other influential decision makers, scientists should be willing not only to accept criticism but to respond with meaningful changes—much as they do so well within the scientific community.

Rather than fret about less-than-worshipful treatments such as that in *Jurassic Park*, the best strategy is simply to get off the pedestal. Scientists need to own up to their limits and be ever vigilant, in concert with other professionals and the public, to situations in which their formidable strengths could misfire. As almost any of the characters of Isaac Bashevis Singer, the great Yiddish writer, might say: "So? Am I not human? And does a human being not make mistakes?" ■

—STEVEN J. MARCUS

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Letters

THE SHAPE OF THINGS TO COME

In "Tomorrow and Tomorrow and Tomorrow" (*TR April 1993*), Warren Wagar fails to mention the most brilliant attempt at scientific prediction ever made—the writer J.D. Bernal's 1929 essay "The World, the Flesh, and the Devil." The piece opens with this challenging statement: "There are two futures, the future of desire and the future of fate, and man's reason has never learned to separate them."

Perhaps the true measure of a civilization is the command it has over its own destiny. Our time has been called the information age, but information is not knowledge, and knowledge is not wisdom. And there is something beyond all of these that is even more important: foresight. It is a rare and often unpopular talent of which the novelist and futurist H.G. Wells remains the most successful exponent—although I have never quite forgiven him for using a gun rather than a rocket to send the first space travelers to the moon.

ARTHUR C. CLARKE
Colombo, Sri Lanka

Warren Wagar's article is the best-informed and most thoughtful introduction to futures studies that I have seen. One point worth amplifying is the growing acceptance of futurists among government leaders. This acceptance has surprised futurists who can remember back a few decades when we were viewed as idle dreamers.

In 1975, Congress established its Clearinghouse on the Future, an in-house service that keeps legislators informed about important trends and forecasts. In 1985, President Reagan invited a group of futurists to the White House for a luncheon meeting with top administration leaders, including George Bush. (The discussion focused largely on how to improve education.)

Vice President Al Gore is a committed futurist who has spoken at World Future Society meetings and has long urged the federal government to establish a future-oriented Office of Critical Trends Analysis. And President Clin-

ton's science advisor, John H. Gibbons, was formerly director of the congressional Office of Technology Assessment, which was established with futurist support in 1972. Gibbons himself has participated in numerous futurist activities.

EDWARD CORNISH

President
World Future Society
Bethesda, Md.

I suspect that H.G. Wells and his fellow futurists have a lot in common with their colleagues who read crystal balls or tarot cards: their track record may often appear better than it really is because we tend to remember only those few predictions that come true. To my knowledge, there are still no time machines or invisible men, even though Wells envisioned both.

If futurists share any ideology, it is an unshakable optimism and a belief in eternal progress. Even those who predict dismal outcomes believe that there are ways to avoid them. However, given the human propensity to opt for short-term gain and ignore the possibility of long-term disaster, a pinch of pessimism might be appropriate.

ROBERT J. YAES
Lexington, Ky.

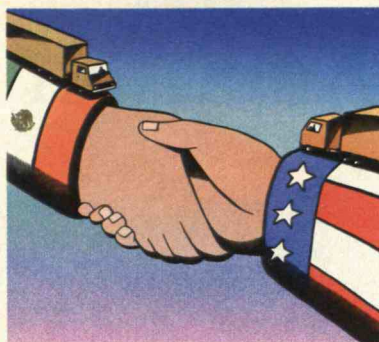
GRASSROOTS GREENING

In "The Road from Rio" (*Interview, TR April 1993*), Prime Minister Gro Harlem Brundtland of Norway rightly observes that implementing the agreements of the Earth Summit will depend heavily on the new United Nations Commission on Sustainable Development. And there is some cause for optimism. The agenda for the first full-dress ministerial meeting of the commission says that the contributions of non-governmental organizations are "indeed welcome and considered of value and importance."

That is significant because much of the



LETTERS



progress toward a more secure, equitable, and sustainable way of life on this planet will depend on people power. After all, it was the unprecedented level of grassroots activity that made the Rio conference the success that it was. More non-governmental organizations and citizen groups were involved in the summit and the accompanying Global Forum than in any other world conference.

The Earth Council, now being formed to complement and support the efforts of the Commission on Sustainable Development, will work with such organizations to ensure that grassroots concerns are brought to bear in decision making. From its headquarters in Costa Rica, the council is already trying to heighten awareness of the connection between the environmental and social crises in today's world. The council realizes that cooperative links developed on a people-to-people, organization-to-organization basis can provide a durable foundation for long-term economic ties and thus enhance policies aimed at sustainable development.

Of course, achieving such a goal will take time, and it will most assuredly require action on the part of governments. But there is no need to wait for governments to act. A surge of initiatives from the people themselves will ensure that the roots of sustainable development are firmly implanted at the base of our society.

MAURICE F. STRONG

Chair and Chief Executive Officer
Ontario Hydro
Toronto, Canada

BEYOND NAFTA

Clyde Prestowitz has made a real contribution to the debate over the North American Free Trade Agreement ("Making the Free Trade Agreement Work," *TR* April 1993). Harley Shaiken also has a point when he notes in "Will Manufacturing Head South?" that a loss of high-income U.S. jobs is one of the risks of NAFTA.

But there are also significant potential gains to establishing a free trade with Mexico, as Prestowitz affirms when he concludes that a favorable outcome is

indeed possible if the United States negotiates some changes in NAFTA. The only problem is that the United States will probably never make many of the changes he suggests.

For example, Prestowitz says we need to be sure that the incomes of Mexicans rise so they can buy more American goods. This, he rightly points out, will require a U.S.-led program of debt reduction for Mexico. Such a program is particularly unlikely to be established. Thus we would have an agreement with a low-income country constrained by a \$100 billion debt, much of which was contracted in the irresponsible borrowing and lending of the 1970s and has left citizens with a quasi-permanent burden of interest payments. Handicapped for the foreseeable future, Mexico would be forced to say, "Take our goods or take our emigrants." The influx of Mexicans into our cities could easily surpass a million a year.

Much of the discussion of NAFTA misses the point. What we need is not so much a successful free-trade agreement, whatever that may mean, as a successful Mexico. Unless we go well beyond NAFTA, we may have to share the blame with Mexican leaders for the continuing impoverishment of what will all too soon be 100 million people on our doorstep.

BRUCE R. SCOTT

Paul W. Cherington Professor
of Business Administration
Harvard University

INEXPENSIVE WAYS TO SAVE ELECTRICITY

In "The Real Cost of Saving Electricity" (*Reporter*, *TR* February/March 1993), P.J. Skerrett says MIT economist Paul Joskow and his graduate student Donald Marron have found higher-than-expected costs for utility-sponsored programs that help customers use electricity more efficiently.

At first glance, the Joskow and Marron figures appear to contradict or refute previous findings by the Department of Energy, the utility industry's think tank, and my own organization. But the MIT findings are neither comparable nor valid. They're simply the highly aggregated, poorly characterized, opaquely adjusted costs of savings reported for a small group of utility programs. Those, in turn, are wildly diverse, anecdotally chosen, dubiously representative, often inferior, and among the costliest in the literature. For example, the mean savings Joskow and Marron calculate for business customers cost four to six times as much as was found typical in a review of 58 utilities' programs through 1988, when efficiency cost even more than today.

The cost of utilities' programs does
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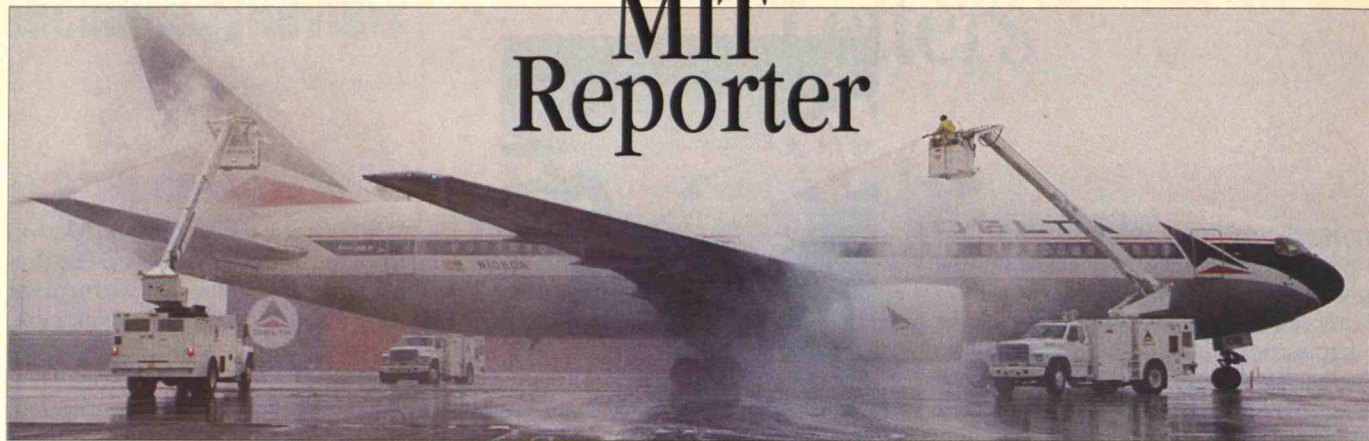
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MIT Reporter



COOL WINGS IN WINTER

 On March 22, 1992, a U.S. Air jet trying to take off in a snowstorm from New York's La Guardia airport plunged into frigid waters, killing 27 people. The accident was the latest in a series caused by icy wings, and it prompted the Federal Aviation Administration (FAA) to more strictly interpret rules that prohibit jets from taking off with ice or snow anywhere on their wings.

But aeronautics researchers say that the regulations gloss over a significant problem: pilots have no practical way to confirm that their planes remain free of ice before takeoff. One expert, who wishes to remain anonymous for fear of losing FAA contract work, says he is so worried that he and his family have stopped flying in winter.

If pilots were certain that the deicing fluid hosed on their planes was still effective at takeoff time, their dilemma would be solved. But, explains MIT aeronautics professor R. John Hansman, no one knows exactly how long the two commonly used deicing fluids do their job once applied. Controlled studies have not verified the approximate "holdover times" published by the FAA, admits Charles Masters, who oversees deicing research for the agency. Instead, those figures are based on expert opinions.

Such information is critical because at most airports jets are deiced near departure gates. Planes must then taxi to the runway, a maneuver that can take 10 minutes even in good weather. Although several large airports avoid this hazard by placing deicing equipment near the runway, most don't have room. Airport managers are also concerned about toxic deicing chemicals running off the taxiways' edges into soil,

To find out how long deicing fluids work after being applied, aeronautics professor R. John Hansman plans to conduct experiments on winglike surfaces. His team will examine the effects of more than 25 variables such as the rate of precipitation, wind speed, and air and wing temperature.

and about potential liability in the event of accidents.

To determine holdover times, Hansman and his students have built an indoor apparatus that sprays precise mixtures of snow, sleet, and rain on winglike surfaces. Previous experiments conducted outside were hampered by rapidly fluctuating weather. The controlled indoor environment should help the scientists determine which of more than 25 atmospheric and other variables, such as wind speed and wing temperature, are most relevant to holdover times.

With data just beginning to trickle in, the MIT engineers have found huge variations in holdover times, depending mainly on air temperature and the amount and rate of precipitation. The numbers range from hours for a cold fog to less than 10 minutes for heavy rain, which washes off the fluid. (Even when air temperature is above freezing, ice can form on wing surfaces if the wing is chilled enough, perhaps from a previous flight.) Holdover times for snow vary between these extremes.

Hansman's shorter-term goals include determining what surfaces on a plane are most vulnerable to icing. "If we can solve this puzzle," says Hansman, "then airlines could tell their ground crews where to look for ice" and spray the most fluid.

To answer such questions, this autumn the scientists plan to use a cam-

era to observe precipitation falling on sections of a slanted flat plate or a cylinder (surfaces that are easy to describe mathematically), both coated with deicing fluid. They will also measure the thickness of the deicing fluid layer in various locations to see how fast it washes off. Then, after developing mathematical models that depict these idealized situations, they plan to repeat the simulations on a surface shaped like a real wing and tune their models accordingly.

Ice-Detecting Sensors


This research may help engineers decide where to install sensors that could detect ice. Many companies have already designed prototypes of such devices, several of which the FAA plans to test over the next several years. One sensor, for instance, consists of a small membrane that is mounted on a wing and induced to vibrate. The membrane oscillates at one frequency when covered with water and another when coated with ice. If the membrane shifts frequencies, then a computer detects the change and relays the information to a cockpit readout. Since most of the prototypical sensors spot ice only on a tiny section of a wing, information on where to place the devices becomes critical, Hansman explains.

Hansman has proposed an ice sensor that avoids the placement issue. On a plane's fuselage, he suggests, engineers could mount cameras that transmit pictures of both wings to cockpit monitors. Then, during winter storms, technicians could spray the wings with deicing fluid mixed with a fluorescent dye such as fluorescein disodium salt that glows only when liquid. A uniform fluorescent glow when the mixture is illuminated with ultraviolet light would mean it was safe

to take off, while danger could be lurking if any part of the wing stopped shining. But this method also has a flaw, Hansman admits: a human observer has to interpret a video image blurred by a snowstorm.

—ROBERT LANGRETH (*The author is an associate editor at Popular Science.*)

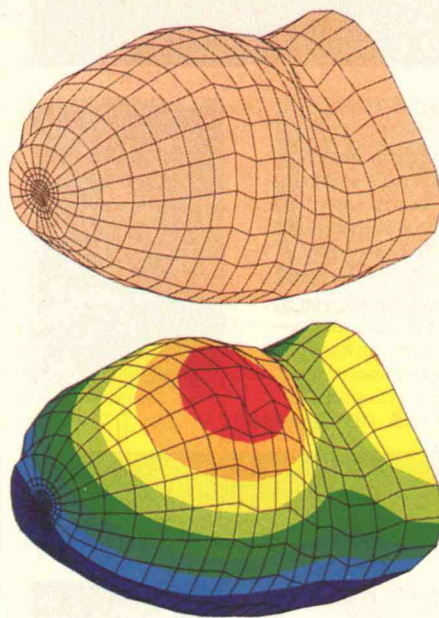
TOUCHING IS BELIEVING

 Whether envisioned as a toy or a tool, virtual reality has entered popular culture as a compelling image of the computer-enhanced future. Wearing special helmets or sitting in front of screens, people are increasingly able to “walk” through simulated doors into imaginary worlds complete with sights and sounds.

Computer scientists would also like virtual environments to offer the sensation of touch, but that requires resolving difficult questions. How does one register, for instance, the roughness of gravel or the stickiness of honey? What information about force, pressure, and various angles in the hand and wrist are associated with the feeling of hitting a hammer? How can computer simulations compensate for the vibrations, friction, slipping, and inertia humans associate with their sense of touch as a matter of course?

A multidisciplinary group of researchers at MIT and elsewhere is making headway in this emerging discipline of “haptics”—the science of manual and motor interactions with the environment. Mechanical engineer Mandayam A. Srinivasan, a principal research scientist at MIT’s Research Laboratory of Electronics (RLE), has spent the past four years developing experimental designs to sort out the cues that contribute to a realistic sense of touch. “Basic understanding of the human biomechanical, sensorimotor, and cognitive systems—such as what information signals travel from the skin to brain and back down—is critical,” he says. To distinguish various activities involved in perceiving an object, Srinivasan has come up with methods such

as anesthetizing the fingertips of subjects or asking them to wear gloves, and then observing how well they can perform a given task. Through these techniques he has found, for example, that the perception of softness depends on the amount of force it takes to depress an object, its tactile quality against the



To determine how the skin can be stimulated to create the sensation of “virtual touch,” mechanical engineer Mandayam A. Srinivasan and graduate student Kiran Dandekar have modeled a monkey finger at rest (top) and the vertical displacement when the finger is pressed by a pointed object (bottom).

skin, and information about how much the hand moves.

Complimenting Srinivasan’s findings, Kenneth Salisbury, another mechanical engineer and a principal research scientist at the Artificial Intelligence Laboratory, has been focusing on developing software and mechanical devices that permit people to control and experience interactions with virtual objects. In simple fingertip interactions, he points out, a person should be able to assess details such as whether a surface is elastic and if the point of contact slips. The haptic

interfaces developed so far by Salisbury’s group simulate contact with virtual objects such as cubes and spheres; the software feeds back appropriate forces when a joystick-like device makes “contact” with the imaginary surfaces.

Other researchers are also grappling with making virtual objects seem realistic. As part of her doctoral research at MIT’s Media Laboratory, Margaret Minsky has developed a system she has named Sandpaper, which simulates textures. “Imagine that you have grabbed a pencil in your hand and you run the point over a finely textured surface,” she says. “The tiny bumps exert force on the pencil so that it moves up and pushes on your hand.” In her system, electric motors and brakes that rely on the activity of magnetic particles exert different forces on a joystick. Surprisingly, Minsky has found that when the motors are controlled to exert only horizontal forces, operators still sense vertical motion, as if their fingers were stroking a textured surface.

MIT’s researchers believe that the earliest commercial haptics applications for virtual environments will be training programs that simulate the use of traditional tools. These could allow medical students to perform surgery on a “patient” without risking anyone’s health. Computer scientists also point to haptics’ value for industrial design. Engineers could simulate the surface of a prototyped coffeepot or test the springs in a car.

But don’t look for sophisticated haptics applications to enter the consumer market in the near future. The dropping cost of computers and microelectronics has made today’s haptics experiments feasible, but Srinivasan says couch potatoes will not be able to don virtual-reality headsets and experience the illusion of touch for at least a decade. “We know enough about vision to determine how many pictures per second it takes to convey a continuous television image,” he says. But no one yet knows enough about touch to fully simulate the feeling of hitting a nail on the head.

—DEBRA CASH

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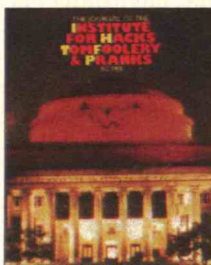
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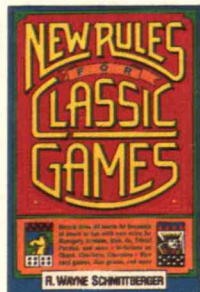
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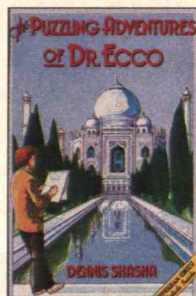


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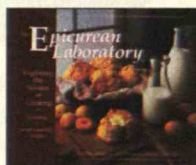


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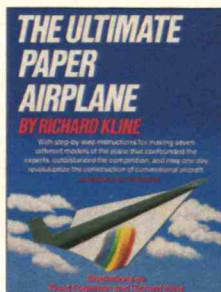


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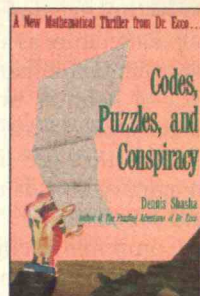
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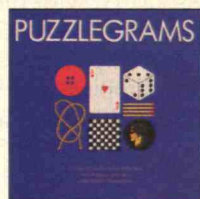


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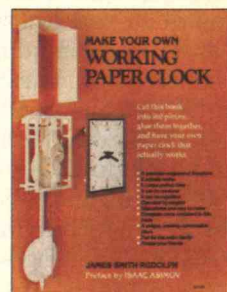


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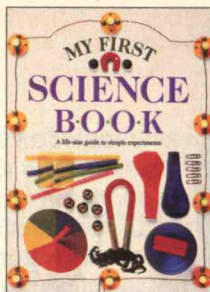


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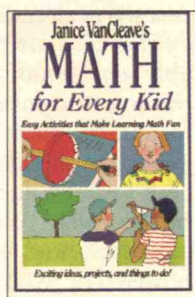
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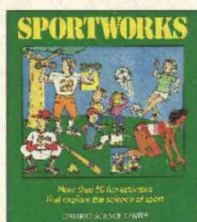
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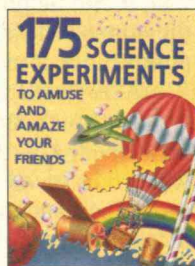


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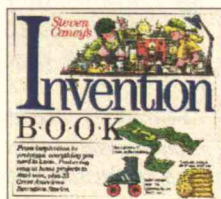
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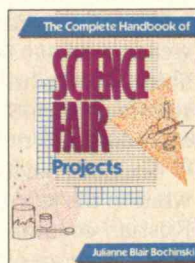


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Trends

Riders in the Stream

This November, three balloonists hope to soar into the jetstream in a revolutionary lighter-than-air craft. If they successfully execute their three-week flight plan, they will be the first ever to pilot a nonstop balloon flight around the world.

No balloon has had the altitude control to stay within the thin, high-speed current of air encircling the globe. But by combining features of hot-air and helium craft, the hourglass-shaped Earthwinds Hilton, which consists of an upper helium balloon and a lower air-filled balloon, could theoretically extend flying time in the jetstream almost indefinitely. The feat would not only put the pilots in the record books but would also enable them to make unprecedented studies of the properties of the jetstream itself, which is largely responsible for weather patterns around the world.

Until now, the limiting factor has been the amount of helium contained in the balloon and the amount of ballast that could be carried on board. In the daytime, as a helium balloon is warmed by the sun, its gas expands and the craft rises rapidly through the atmosphere. To keep it from climbing to a level where the expansion of the gas would cause a catastrophic rupture of the balloon, valves at the top allow some helium to escape. When the sun goes down, the gas cools and contracts, and the balloon starts to sink. To keep the craft aloft, some ballast—usually sandbags, lead shot, or water—is tossed overboard to lighten the load. After a few day-night cycles, both helium and ballast are too depleted to keep the balloon going.

Instead of venting helium and using conventional sources of ballast, Earthwinds will borrow ballast from the infinitely replenishable supply of surrounding air to control both ascent and descent. As the sun warms the helium in the upper balloon, the entire structure will rise, but the air in the lower balloon,

called an anchor balloon, will become slightly heavier than the ambient air at these higher altitudes and act like a brake, slowing and stopping the upper balloon's ascent and eliminating the need to discharge helium.

Then at sunset, as the helium in the upper balloon begins to cool and the system descends, the anchor balloon's relative weight will decrease, allowing the lift balloon to climb back to a stable altitude.

Though Earthwinds could conceivably remain aloft almost indefinitely in this so-called passive mode, it would not be able to maintain a flight path level enough to stay within the jetstream; the craft's passive fluctuations would simply be too great. To control altitude more effectively and precisely, a large fan, powered by two Honda car engines connected to electrical generators inside a 20-foot pressurized gondola, will force as much as 550,000 cubic feet of pressurized air for ballast into the 100-foot-diameter anchor balloon. Because the ballast can be increased or decreased at will, it can be pumped up to maintain the same altitude during the day or pumped out at night.

NASA tested a similar dual-balloon system, much smaller and without a crew aboard, in the late 1980s that did succeed in traveling around the world, providing data on wind patterns. It was thought that the weight of food and water for the crew and fuel for the engines would be limiting factors for such a craft.

But the ability to control the altitude at will could make the round-the-world goal attainable for a balloon loaded down with a crew. By guiding the craft to exactly the right altitude, based on information radioed from an expert weather consultant, the crew should be able to enter and stay within the jetstream and pilot the vessel at speeds exceeding 150 miles per hour.

The potential for atmospheric research while in the jetstream is what convinced Russian cosmonaut Vladimir Dzhanibekov, veteran of three space flights and



With an upper helium balloon for lift and a lower air balloon for ballast, the 280-foot-tall Earthwinds craft may be the first piloted lighter-than-air vehicle to ride the jetstream around the world. The three-passenger gondola (below) will carry wind gauges, particle detectors, and other scientific instrumentation for conducting atmospheric research.



now director of cosmonaut training in Russia, to sign on as a member of the Earthwinds crew, joining Arizona pilot Larry Newman and balloonist Richard Abruzzo. "We'll make this mission more interesting not only for record-beating, but also for nice scientific experiments," Dzhanibekov says. Already, a half dozen experiments, provided by both American and Russian scientists, are part of the mission. They are designed to study wind-circulation patterns, variations in the thickness of the ozone layer, aerosol-particle contamination at high altitudes, and background radiation levels from cosmic rays.

Not-So-Smooth Sailing

Despite the enthusiasm of the Earthwinds team, some balloonists question whether the new craft can pull off the flight. Balloon builder Per Lindstrand, who designed the world's largest hot-air balloon for a trans-Pacific flight with British entrepreneur Richard Branson two years ago, thinks the wind-shear forces encountered when the towering 280-foot-high Earthwinds enters the jetstream could render it unmanageable, with the upper balloon subjected to powerful winds while the lower is still in calmer air. The vessel's team, however, thinks a short test flight into the jetstream three years ago in a half-scale model proved that it can work.

A previous attempt to circumnavigate the globe in Earthwinds this past January did end in failure when the balloon's initial ascent was severely limited by frigid weather conditions that night at an airfield outside Reno. Because the helium couldn't expand enough at ground level—where the effects of the unusually high air-pressure system accompanying the cold front were most pronounced—the balloon crashed into a mountain ridge just a half-hour after liftoff. But Newman contends that cold weather won't create a problem again. In the unlikely event that there is another cold spell in Reno, he says, the crew can simply wait it out.

—DAVID CHANDLER (The author is a reporter for the Boston Globe.)

The Monkey's Medicine Chest

Deep in Tanzania's Mahale Mountains under the canopy of its tropical rainforest, a 34-year-old chimpanzee slowly stirs from an unsettled sleep. She seems lethargic and has diarrhea and discolored urine. Instead of eating with the rest of her group, she proceeds directly to a plant called *Vernonia amygdalina*, rarely consumed by chimpanzees. She gently strips the bark and the leaves from a young branch and chews its tender pith, drinking the juice and spitting out the fiber. Several hours later, she feeds on more of the plants. By the next day she has recovered fully and eats normally.

Michael Huffman, a primatologist at Japan's Kyoto University who observed this event while peering through the brush back in 1989, found that *Vernonia amygdalina* is saturated with a bitter-tasting substance called vernonine, a powerful antibiotic and antiparasitic compound. In fact, the plant and its medicinal properties are well known to west African healers, who regularly use its leaves, roots, and bark to treat gastrointestinal disorders, scurvy, malaria, and rheumatism.

Huffman is now one of a growing number of researchers observing chimpanzees, bears, and other wild animals eating medicinal plants. The scientists speculate that if animals have already learned to medicate themselves using their environment as a drugstore, following them around may be the fastest way to find new drugs among the millions of undiscovered plant species growing in the world's forests.

While in Kibale, Uganda, another researcher, Harvard anthropologist Richard Wrangham, observed several sick chimps carefully selecting and swallowing the leaves of a plant called *Aneilema*, which has suspected antiviral



Rainforest animals such as the Tanzanian chimpanzee have been observed medicating themselves with plants known to contain powerful drugs. Researchers believe the animals offer a shortcut to finding new medications among the millions of forest plant species.

properties. Other chimps swallowed leaves from *Rubia*, a plant prized by local healers for its antifungal and antiparasitic compounds. And still others swallowed *Aspilia* leaves, traditionally used by Africans for burns, rashes, whooping cough, and gonorrhea. Wrangham believes the chimps taste-test the *Aspilia* leaves for a compound called thiarubrine-A, a brilliant red sulfur-containing oil that is "one of the most powerful antibiotics ever discovered, killing a variety of human and animal pathogens, bacteria, viruses, and fungi at lower concentrations than any known drug."

Eloy Rodriguez, a biochemist from the University of California, Irvine, who has spent the past 15 years collecting and testing medicinal plants used by animals in the rainforest, first analyzed thiarubrine-A in 1984 and found that it was also effective in lab tests against tumors. He contends, "The drug was as good if not better against solid tumors than adriamycin," a well-known cancer drug.

Yet another researcher who has

observed primates sampling nature's medicine chest is Karen Strier, an anthropologist from the University of Wisconsin. Strier witnessed miqui monkeys in the Atlantic forest of Brazil eating 17 different plants that indigenous people in the Amazon use to control parasites.

Even more startling, Strier believes that the miqui females are using plants to regulate their fertility. At the beginning of mating season, she says, female miquis go out of their way to consume several species of legumes containing isoflavonoids, chemicals similar to estrogen, a female hormone, and to stigmasterol, a steroid used to synthesize progesterone, another female hormone.

Primates are not the only animals that use medicinal plants. Shawn Sigstedt, a Harvard ethnobotanist, found that when black bears at the Cheyenne Mountain Zoo in Colorado Springs were given the root of *Ligusticum porteri*, they chewed it into a mulch and spread it onto their fur to control parasites. The root has been used by southwestern Native American healers for thousands of years as an insecticide, heart tonic, antibiotic, and anesthetic.

Though all the plants that animals have been observed using for medicinal

purposes are well known to local healers, researchers believe that further study of animal behavior will prove beneficial. "Because of the encroachment of Western civilization, indigenous peoples are rapidly losing touch with their ancient cultures," says Sigstedt, "and with each successive generation, less knowledge about medicinal herbs is being passed on by tribal healers."

A New Science Threatened

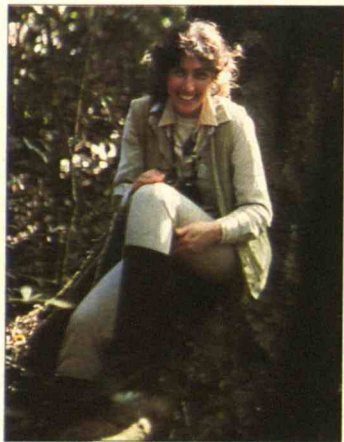
"I would rather follow the animals," concurs Strier, "because unlike the indigenous peoples, they have constant access to all of these plants and have continued to use the forest as their pharmacy for thousands, if not millions, of years." As a result, she believes, "there may be much that animals can still teach us about—as yet—undiscovered drugs."

In fact, the American Association for the Advancement of Science last year held its first symposium on the new science of zoopharmacognosy—the study of medicinal-plant use by wild animals. But the discipline is already threatened as the forests containing the potentially powerful medicinal plants shrink by as much as 50 million acres per year and the populations of animals that can lead researchers to them dwindle proportionately.

No one is more aware of this staggering depletion than researchers in the field. Strier, for one, has seen Brazil's Atlantic forest wither to less than 5 percent of its original size and the miqui monkey population shrivel from many thousands to a few hundred.

The zoopharmacognosy community is trying to stem the tide of forest depletion with the fruits of their own labor. For example, Wrangham and Rodriguez are negotiating with a pharmaceutical company to market a new drug based on thiarubrine-A derivatives, for which they hold patents, with the stipulation that a percentage of the profits be used to preserve the animals and the forest in the host country. Says Wrangham, "I regard this research as a vital component in the war against the loss of the forests."—JAMES GRISANZIO

Karen Strier, an anthropologist working in the Amazon, thinks animals may have more to teach us than local healers, who are gradually losing knowledge of the forest as a pharmacy.



Educating Engineers for the Real World

How well are engineering schools preparing students for the working world? To find out, the National Society of Professional Engineers (NSPE) recently conducted a two-year survey of some 1,000 employers in industry and government.

More than a third of the respondents said the current engineering baccalaureate programs do not produce engineers who can meet their company's basic needs. And nearly half said they have to provide additional training for new engineers beyond "on-the-job" experience.

Industry leaders say technical know-how alone is no longer enough. "When we interview college graduates, we do little to analyze their technical skills," says Stephen Tucker, program manager of university recruiting for General Electric. "We assume all the graduates from



the schools where we recruit have those skills." Instead, GE looks primarily at five other qualifications: communication and interpersonal skills, analytical ability, self-confidence, personal initiative, and the willingness to adapt to change. Unfortunately, says Tucker, "engineering schools are not covering any of those areas." As a result, two-thirds of GE's new engineers undergo special in-house educational programs before they start their jobs.

Indeed, 8 out of 10 employers surveyed placed a high value on teamwork, but only 1 in 4 felt graduating engineers were well prepared in this area. Similarly, 7 out of 10 highly valued leadership, but only 1 in 10 thought graduates had developed this quality. When asked which areas of study would merit more attention in a revised curriculum, more than 60 percent said students need to improve communication skills, while about 45 percent said they should get more practical experience.

Engineering educators vary in their response to such criticisms. At one end of the spectrum are reformers like Alfred Ingersol, chair of the NSPE study and professor emeritus at UCLA's Department of Civil Engineering, who wants students to complete either a five-year undergraduate program or a master's program before awarding them their first professional engineering degree. He believes the extra time is needed for teaching additional courses in humanities and ethics, which he feels will not only address employers' concerns but also help engineers become true professionals rather than "glorified technicians."

However, industry manifests little support for increasing the number of years of engineering school. Only 1 in 4 of the industry leaders said they would favor a five-year undergraduate degree program, just 1 in 10 agreed that a master's should be the first professional engineering degree, and fewer than 1 in 4 said their firms would increase salaries for entry-level engineers from longer undergraduate programs.

Some industry representatives say that 5-year programs would actually hurt the quality of engineering graduates since many students would opt for other 4-year disciplines. They also point out that while the current engineering curriculum is theoretically only 4 years, it is so demanding that the average engineering student takes 4.7 years to complete the curriculum. Adding another year of course work could lengthen the average program to nearly 6 years.

A second group of educators favors significant but less draconian changes in the curriculum, the most popular of which entails adding a co-op program. This approach, the only five-year schedule industry supports, would allow students to use an internship to develop leadership and teamwork skills. Dow Chemical, for one, not only recruits co-op students more heavily but also offers them significantly higher salaries.

"The trend toward co-op programs is a recognition of the fact that engineering at its core must have a feel for practical

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applications," says Woodrow Leake, deputy executive director for the American Society of Engineering Education. Schools must do more than simply throw the student into the workplace.

Blending Theory and Practice

Before 1950, Leake explains, engineering was seen primarily as a pragmatic vocation. But educators have since grabbed onto the idea of "engineering sciences," emphasizing the more theoretical and intellectual aspects of engineering at the expense of practical applications.

The task now, Leake says, is to incorporate the down-to-earth aspects of engineering in the classroom without sacrificing the theoretical. For example, besides merely understanding the complex concepts of electromagnetic waves and quantum theory, electrical engineering students need to know how to design working circuits and components as well as understand the cost, safety, and environmental trade-offs of the various design options. Integrating these aspects of engineering will require relating conventional textbook exercises to design projects and ethical discussions.

Some educators defend the current system against criticism either from industry or university reformers and say they are battling an image problem as much as an academic one. "Engineering schools do a much better job than the survey implies," says Donald Rathbone, dean of engineering at Kansas State University. He points to the 92 percent of respondents who say that they would continue training new graduates even if the engineering curriculum were revised.

Even some reform advocates, such as Constantine Papadakis, dean of engineering at the University of Cincinnati and a strong supporter of five-year co-op plans, feel that not all the criticisms are valid. "It's impossible in either 4 or 5 years to prepare someone for everything they're going to need in a 40-year career," he says. "Giving people the tools and the desire for lifelong learning—that's the key."

—MUBARAK DAHIR



More Than Just Sewage Treatment

Wetlands have long been prized as valuable wildlife habitats. (See "Uncertain Ground," page 20.) But now several communities are finding they can also be used as a low-cost method of treating wastewater. By taking advantage of the ability of a swamp, bog, marsh, or fen to act as a living filter of the water that flows through it, several communities have recently constructed wetland systems to treat sewage or reclaim water already processed in conventional facilities.

Union, Miss., a small rural town of about 2,000 residents, has constructed a wetlands treatment facility for about \$500,000 dollars, some \$750,000 less than the cost of building a new treatment plant. And maintenance costs are minimal, says Donald Thomas, Union's wastewater superintendent. He or his assistant spend only about two hours a day at the station, taking readings, cutting grass, and clearing turtles from the channel.

The rest of the work is done by the marsh itself. As wastewater flows slowly through marsh vegetation, suspended solids settle to the bottom and are broken down by microbes in the water and on the plants' roots. The byproducts, mainly nitrogen and phosphorus, are absorbed by the marsh plants and con-



By flooding constructed wetlands with discharge from the local sewage-treatment plant, the town of Orlando not only purifies the effluent but gains a new wildlife refuge and a park.

verted into plant tissue.

The biodegradation of sewage normally depletes dissolved oxygen in the water, often to the point that it cannot support life. In fact, conventional treatment plants use expensive mechanical aerators to re-oxygenate the water. But marsh grasses send oxygen from their leaves to their roots and into the water to help them survive in soggy soils.

Robert Bastian, an environmental scientist who monitors constructed wetlands projects for the Environmental Protection Agency, notes that communities have been constructing wetlands for a variety of purposes. The water that exits the marshes is cleaner than the

effluent pumped in and thus can be used for recreation, agricultural irrigation, industrial processes, groundwater and stream augmentation, or even as a supply of drinking water.

Wetland wastewater-treatment systems can also double as lush new parks with ample habitats for fish and migratory birds. For example, the towns of Arcata, Calif., and Orlando, Fla., chose to use the discharge water from conventional treatment plants to expand their wetlands into wildlife refuges rather than install long pipes to simply carry the effluent to the ocean. Residents of both cities have since been flocking to their refuges to hike, jog, or bird watch.

The Arcata and Orlando marshes are "free water surface flow systems," the most common variety of constructed wetlands. To create these systems, the landscape, usually an area not currently classified as a wetland, is modified to provide adequate water flow and drainage and is planted with a combination of marsh grasses and floating plants.

The other type of constructed wetlands facility, a subsurface flow system, uses plants that grow on the rocks that loosely fill the water channels. These systems can be problematic both in the construction and operation phases, as algae or sand can clog the rocks and stop up the system. But when maintained sufficiently, subsurface systems help contain the unpleasant smell and sight of sewage as it works its way underwater between rocks and plant roots.

Land Limitations

One factor limiting wider implementation of wetland systems is the amount of land they require. For example, the system in Crowley, La.—designed to handle up to 4 million gallons of domestic wastewater per day and serve a population of some 28,000—requires about 78 acres of land. Thus most of the wetland treatment systems currently serve rural communities where land is relatively abundant and inexpensive.

However, Bill Wolverton, a former NASA researcher who pioneered the

design of several natural systems for treating wastewater in space, has developed an indoor system that he believes could be used to deal with land area limitations. For the past three years he has been using a miniature subsurface flow system in his home that uses pumps, pipes, and large planters filled with diffenbocia, areca palms, and peace lilies. "They've never been fed or watered except when you flush the commode," he says, "and the plants provide the additional benefit of purifying the air."

Wolverton envisions large-scale systems that circulate through entire buildings to treat portions of a city's sewage. Toward that end, he recently expanded the concept of his home system in a design for a tightly sealed, two-story atrium in the new math and science building at Northeast Mississippi Com-

munity College.

"People begin to show interest when they find out a wetlands facility can be used for more than just sewage treatment," says EPA's Bastian. But while hundreds of constructed marsh-treatment systems are currently operating successfully, he has found that some communities still have difficulty getting these systems installed. Part of the problem, he observes, is that the concept is based on managing nature instead of machinery, and most regulators and technical consultants working in sewage treatment have little corresponding experience. To support communities exploring wetland systems, Bastian is compiling a collection of case studies that show how these operations have been successfully installed and managed.

—SHAWNA MOOS



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Risky Reactors

Fact: The former Soviet Union built 17 reactors using the same flawed design that led to the world's worst nuclear accident at Chernobyl in 1986. **Fact:** 15 of these reactors are still operating today.

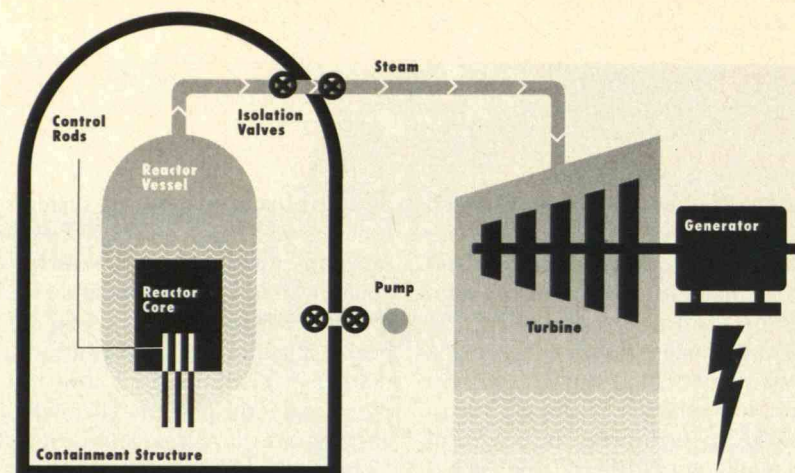
Western experts are almost unanimous in the view that these nuclear plants should be phased out. "The older reactors in the former Soviet Union are like pressure cookers rattling on the stove," says D. J. Peterson, a research fellow at the RAND Corp. "I'm all for shutting them down as soon as possible."

But despite international agreement that the Chernobyl-style reactors pose a serious safety risk, few countries are actually working to shut them down. The prevailing view seems to be that to do so in the near future is impractical: too many of the former Soviet states continue to depend heavily on them for power and are unprepared to tap alternative sources of electricity.

Fear about the safety of these reactors stems from their fundamental design. Virtually all other reactors in use today are designed so that the nuclear chain reaction stops automatically if cooling water is lost. But the Chernobyl-style design, known as RBMK—the Russian initials for high-power controlled reactor—lacks this crucial safety feature: its nuclear chain reaction continues, and power output increases, when coolant is lost.

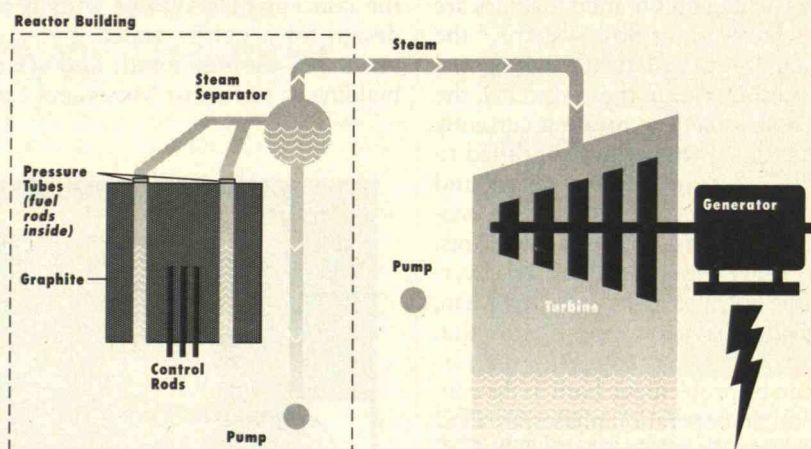
The problem is caused by the fact that the plants' nuclear fuel rods are surrounded by graphite—a combustible material—rather than the water used in most Western nuclear plants. The graphite is used to control the nuclear reaction by capturing the neutrons emitted by the fuel rods. But because graphite ignites when overheated, the plant could become consumed in fire in the event of a power surge—the scenario that occurred at Chernobyl.

Equally distressing, the designers of the RBMK reactors neglected to include the massive steel and concrete containment structures—engineered to trap



Though lacking critical safety features, 15 Chernobyl-style RBMK nuclear plants still operate in the former Soviet Union. All other designs—such as the pressurized water reactor (above)—shut down automatically if water surrounding the

fuel rods is lost, and steel and concrete containment structures trap radiation leaks. The RBMK reactor designs (below) bathe fuel rods in graphite, which burns like coal when overheated, and lack any provisions for containment structures.



large radiation releases—that have become a hallmark of Western-style reactors. The list of problems with the RBMK reactors also includes inadequate fire-protection systems, poorly designed control rooms, flawed electrical and safety systems, and overly complicated piping arrangements.

According to figures compiled by the U.S. Council on Energy Awareness, a nuclear industry lobby group, Russia now generates no less than 10,000 megawatts from reactors of the Chernobyl design—more than half the electricity supplied by the country's 24 operating nuclear power plants. To make matters worse, the Russian parliament has announced plans to begin operating a new Chernobyl-style reactor later this year.

The situation is even more dramatic in

other former Soviet states such as Lithuania. In 1986, just months after the Chernobyl disaster, Lithuania's second RBMK reactor—the largest in the world, generating 1,500 megawatts—went on line in the southeastern part of the country. Local antinuclear sentiment ran high, and activists managed to curtail a third reactor under development at the same site. But with the nation's independence in 1989, everything changed. Today Lithuania obtains some 58 percent of its electricity from its two RBMK reactors, and safety concerns have paled beside the energy independence they provide.

The case of the Ukraine may be even more instructive. This nation, home to the Chernobyl site, declared a five-year moratorium on all new nuclear projects

in the aftermath of the accident. Now, according to Edward Kayukov, a research associate at the Center for Russian and Eurasian Studies at California's Monterey Institute, the Ukraine receives only one-quarter the amount of oil it formerly received in the Soviet system, and the nation is looking for a way around the moratorium to start up three new reactors that stand near completion.

International Intervention

Various nuclear agencies have focused on trying to improve the safety conditions at these plants, even if they cannot be made to comply with international standards. For example, the International Atomic Energy Agency of the United Nations has sponsored inspections at these and other sites and developed standardized accident procedures. As part of the program, IAEA designed an international rating scale that specifies relative danger to public health and helps facilitate prompt communication of any accident that may occur.

The World Association of Nuclear Operators distributes plant safety and reliability information to its member utilities in the former Soviet Union and other countries over a computerized system with offices in Moscow, Atlanta, Paris, Tokyo, and London. WANO analyzes events at nuclear power plants worldwide and disseminates the lessons learned about the precursors of serious accidents. The group also transmits safety performance data so that members can compare the results with their operations and adjust priorities and resources accordingly. And it offers information on the full range of safety equipment, from updated control panels to improved fire-fighting gear.

Sweden, Germany, France, Britain, Canada, Japan, and the United States have all sent emissaries and offered technical assistance and funding to improve the safety of nuclear plants in the former Soviet Union. At the Ignalina nuclear complex in Lithuania, for example, operators have established an exchange agreement with their Swedish

and Russian counterparts to improve safety and maintenance. Employees also recently underwent training at the Berlin-based Institute for Reactor Safety and are working with French authorities to develop a training simulator for plant personnel.

Ukrainian representatives recently joined experts from France's Institute of Nuclear Protection and Safety and Germany's Institute for Reactor Safety to upgrade several existing Ukrainian reactors and to become versed in the most recent international licensing guidelines. Several Ukrainian plants will also be the target of a joint U.S., Russian, and Ukrainian effort to improve reactor safety, employee training, and risk reduction.

Such efforts are helpful, says RAND's Peterson, but they cannot alter the fundamental flaws in the RBMK design or

the lack of quality control in plant construction. International assistance, he suggests, ultimately supports an "addiction that could prove dangerous for everyone in the long run."

The latest proposal, by the World Bank and the International Energy Agency, is for the major industrial democracies to replace the dangerous Soviet reactors with gas-fired power plants. A report, to be presented to these nations' leaders at the summit talks in Tokyo scheduled for July, contends that the changeover could be accomplished by the year 2000 for \$18 billion, some \$6 billion less than the cost of refitting plants with modern safety features. The proposal will likely be met with resistance, however, because the former Soviet countries may have to spend billions of dollars more annually on natural gas.

—SETH SHULMAN

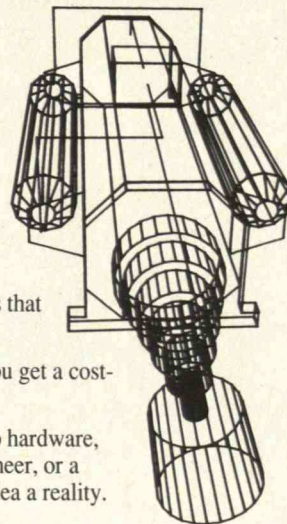
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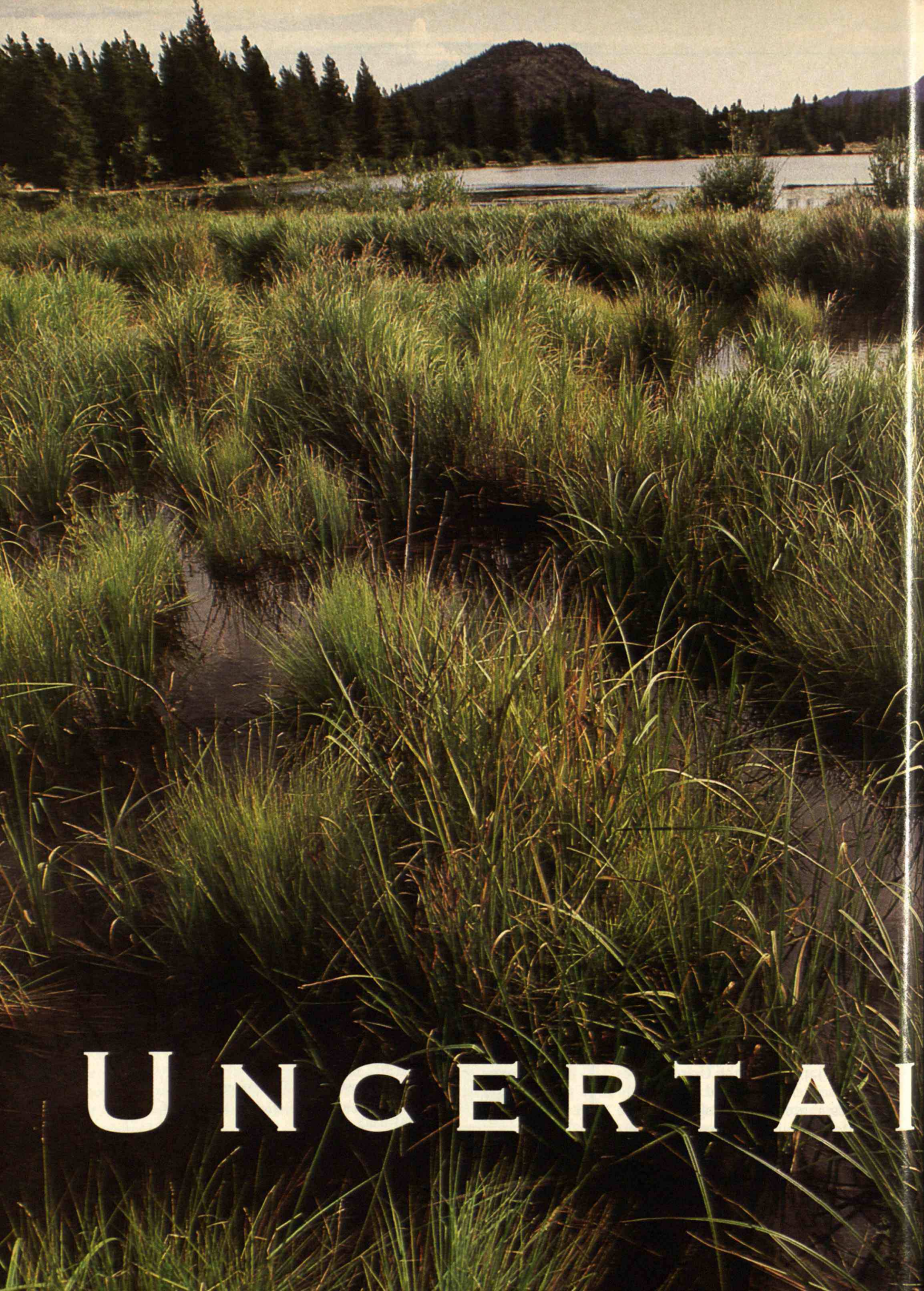
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THE LONG WAR OVER WETLANDS REGULATION
REFLECTS AMERICANS' AMBIVALENCE WHEN
PRIVATE PROPERTY AND PUBLIC
RIGHTS INTERSECT.



AN old woman in Wyoming cannot tend her rose bed because the government accuses her of disturbing protected wetlands. A hard-working Hungarian immigrant spruces up his property, removing tires and other debris; the federal government jails him for filling wetlands. Farmers hesitate to plow and plant their fields for fear of running afoul of federal wetland regulations. 🌹 Reading stories like these in the national press, one might suppose that tax-supported bureaucrats are prowling the countryside like vigilantes, trampling the rights of innocent property owners. In fact, the parable about the rose garden, which appeared in a *Wall Street Journal* editorial, is fiction. John Pozgai, the Hungarian immigrant, filled nine acres of wetlands in defiance of

N GROUND

BY DOUGLAS A. THOMPSON AND THOMAS G. YOCOM

local, state, and federal regulatory agency warnings and a court order requiring him to stop. And for the past 15 years, most agricultural activities already under way have been exempt from wetlands regulation.

Such horror stories are but one symptom of the intensifying conflict over the future of America's wetlands, a clash rooted in the ambivalence many Americans feel about the public value of environmental protection versus the rights of property owners. This schism is nowhere more divisive than in the area of wetlands regulation, for three-quarters of the nation's wetlands lie in private hands. Ever more vigorous enforcement of wetlands regulation has provoked bitter opposition from both industry and groups championing the rights of property owners.

As the Clean Water Act comes up for reauthorization in the next year or two, the provisions governing wetlands will be by far the most hotly debated component. Major environmental groups have vowed to make wetland protection a key issue. The Clinton administration confronts a situation in which strong opinions are as common as good information is scarce; key scientific and policy questions need resolution.

A look at the 20-year history of wetlands protection reveals a combustible mixture of science and ideology. And the debate, while important in its own right, has important implications for other critical environmental programs, such as the protection of endangered species, in which the rights of property owners may at times conflict with the common good.

A Neglected Resource

Known variously as swamps, marshes, bogs, and fens, wetlands form at the interface between land and water. Some are covered or saturated with water throughout the year; others are partially or completely dry for weeks or months. Only the composition of the soil, or the presence of characteristic plants such as cattails, bulrushes, and red maples, may indicate that a given area is wetland.

U.S. wetland ecosystems range from permanently frozen Arctic tundra to languid deep-water swamps in the South; from Dakota prairie potholes and northern quaking bogs to wet meadows in mountain regions. Although saltmarshes and mangrove swamps ribbon portions of the coast, more than 97 percent of the nation's wetlands are freshwater systems. In some areas, such as the tundra of Alaska or the lowlands of Louisiana, wetlands dominate the landscape; elsewhere, the natural limitations of climate or sustained human depredation have made them scarce. Overall, wetlands comprise 6 to 9 per-

cent of the surface area of the lower 48 states.

The dual nature of wetlands—neither entirely land nor entirely water—in part explains the competing views of them within our society. The same area may be an important hydrological and biological component of a watershed and yet be zoned and taxed as residential or commercial property.

Over the last 20 years we have learned much about the consequences of destroying wetlands. These areas are among the most productive ecosystems on earth, vital to the nation's environmental and economic health. Our fish and wildlife populations, including many rare and commercially important species, rely on wetlands for survival. Two-thirds of the species of Atlantic fish and shellfish that humans consume depend upon wetlands for some part of their life cycle, as do nearly half of all federally listed threatened and endangered species. More than 400 of some 800 species of protected migratory birds, for example, rely on wetlands for feeding, breeding, and resting.

Wetlands also purify water by filtering and settling sediments and pollutants (see *"More Than Just Sewage Treatment,"* page 16). During floods, wetlands protect lives and property by slowing the flow of water; during coastal storms, they buffer shores against damage and erosion. They are also a source of products such as cranberries, peat, timber, and saltmarsh hay. Some of our most popular recreational activities, including hunting, canoeing, and fishing, occur in wetlands. And wetlands provide open space, an important but increasingly scarce commodity.

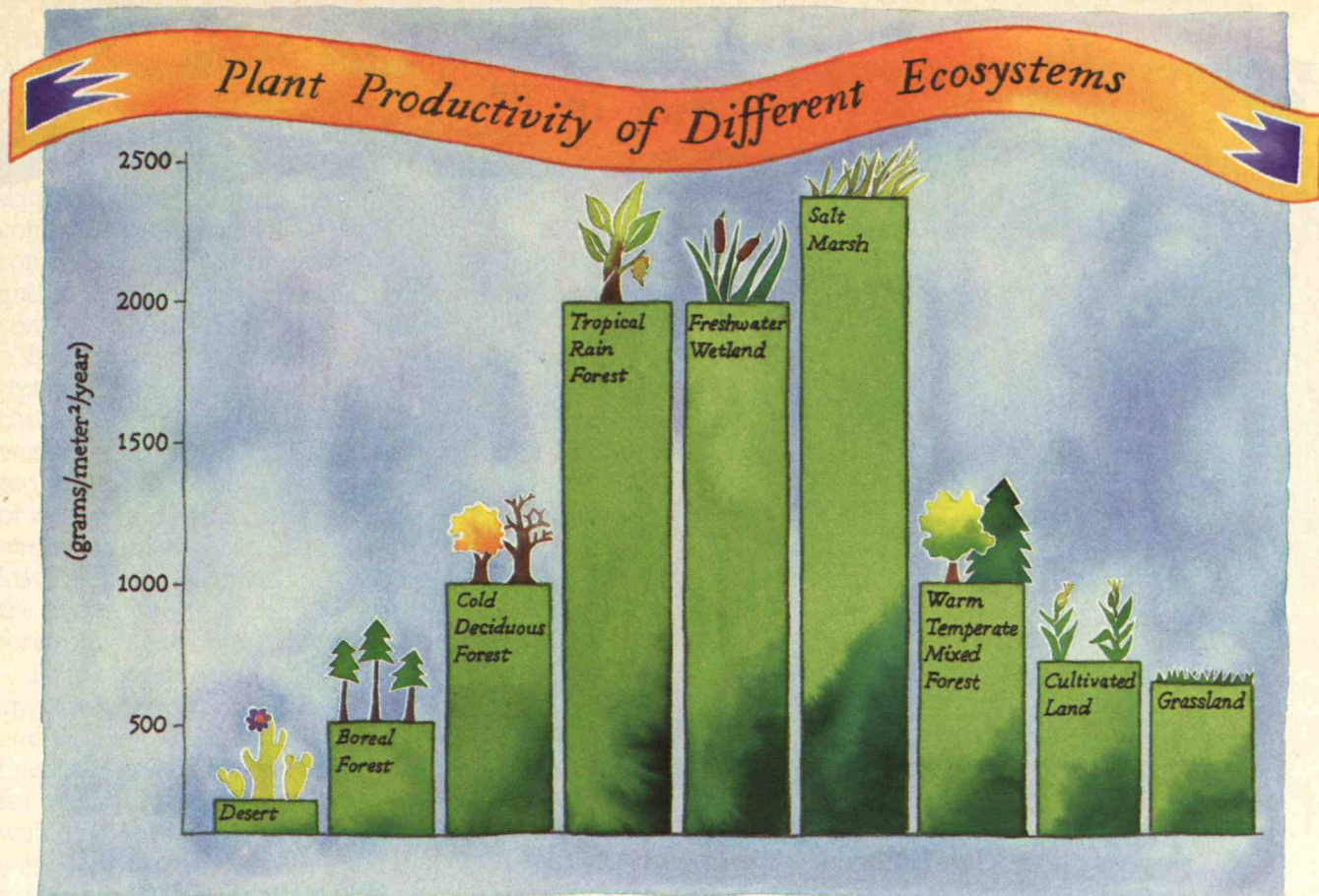
Despite their value and relative scarcity, wetlands continue to be sacrificed for short-term economic goals with little regard for the long-term environmental and social consequences. The U.S. Fish and Wildlife Service estimates that only about 95 million acres of wetland—half the nation's original endowment—remain in the lower 48 states. Of these, we are losing more than 250,000 acres each year—about 30 acres every hour. Some states, such as Ohio, Iowa, and California, have lost more than 90 percent of their wetland endowment to agriculture or the construction of highways, reservoirs, industrial complexes, residential developments, and shopping malls.

Inauspicious Beginnings

When the Clean Water Act was passed in 1972, few observers recognized the potential significance of Section 404. This provision regulates the discharge of dredged or fill material into "the waters of the United States," and thus affects a wide array of construction activities in a range of aquatic habitats.

Section 404 was controversial at birth. The U.S. House and Senate agreed that the Environmental Protection Agency (EPA) and the Army Corps of Engineers should each have a role in the new program, but differed

DOUGLAS A. THOMPSON is chief of the Wetland Protection Section for the Boston office of the U.S. Environmental Protection Agency. THOMAS G. YOCOM is a wetland program expert in EPA's San Francisco office.



Wetlands are astonishingly productive. The biomass produced in freshwater and saltwater wetlands each year rivals and even exceeds the amount produced in rainforests.

over which agency should have primacy. In the end, the legislators compromised: the corps would administer the program on a day-to-day basis but would be bound by environmental regulations known as the "404 guidelines," which EPA would develop. EPA also retained the right to veto a corps' decision to grant a permit if the project would have an unacceptably adverse impact on the environment. The agencies share enforcement authority.

The scope of the Section 404 program did not become clear until 1975. In a landmark decision, *NRDC v. Calloway*, the district court for the District of Columbia ruled that Section 404 jurisdiction includes all U.S. waters. Until then, the corps had argued that the statute applied only to traditionally navigable waters. Calloway clearly placed wetlands under the protective aegis of the Clean Water Act—and thereby drew anti-environmentalists' ire. During the reauthorization of the act in 1977, Congress defeated by a single vote a proposal to undo the effect of Calloway. (Sen. John Chafee [R-R.I.] stayed on the floor to cast the deciding vote despite the death of his mother that morning.)

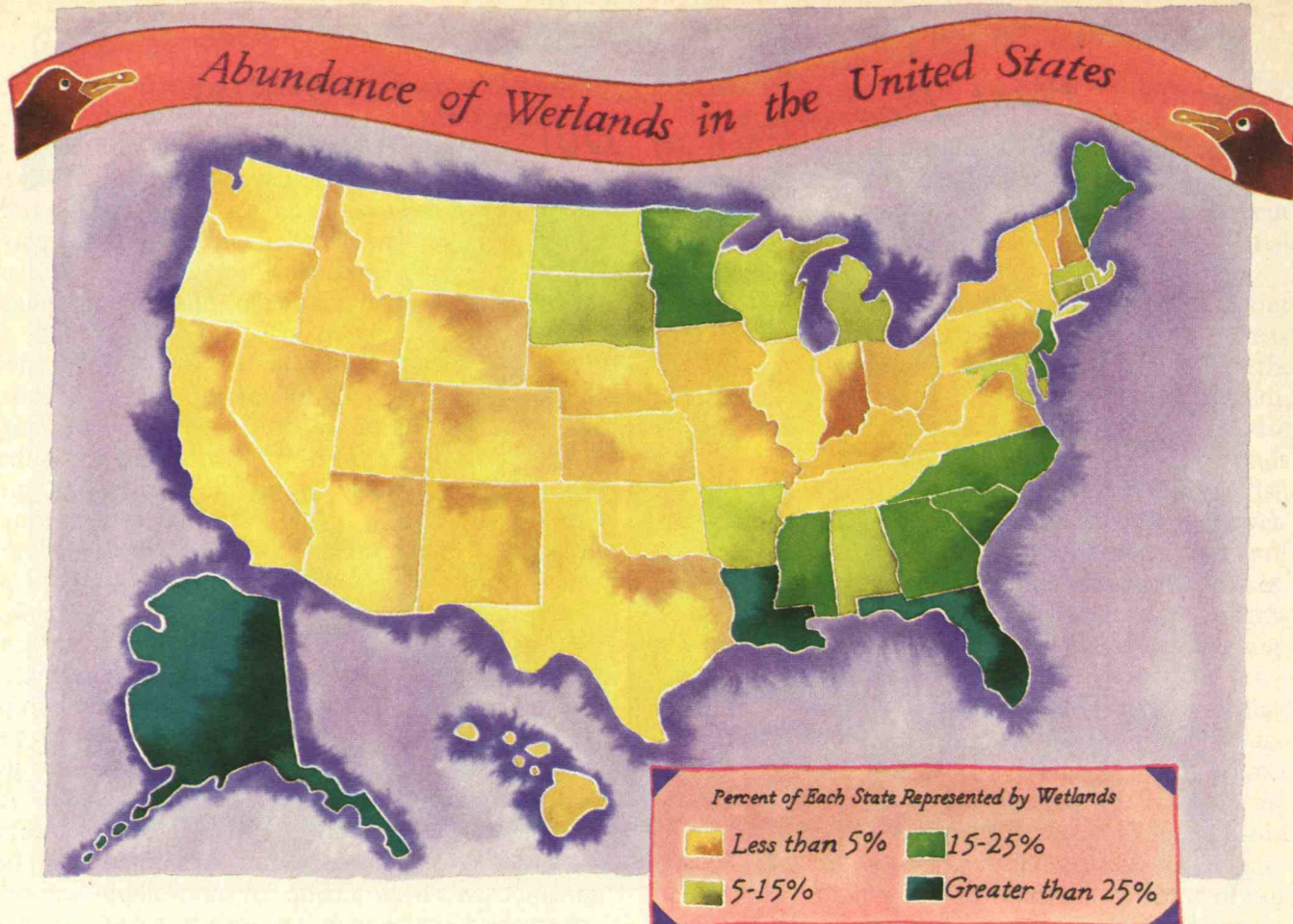
Although Calloway forced the corps and EPA to grapple with how to share authority, the program remained only sporadically effective; its chief benefit may have been, as one wag observed, to turn a "disor-

derly loss of wetlands into an orderly loss of wetlands." However, in the waning days of the Carter administration—Christmas Eve 1980, to be exact—EPA promulgated more stringent guidelines prohibiting permits for projects that, among other things, would cause significant or avoidable impacts to wetlands. The program now combined geographic scope with a powerful regulatory punch.

The Reagan administration targeted the wetlands program for regulatory reform and advanced a number of proposals to weaken federal protection. Most of these were defeated, but the corps generally lived up to its reputation as never meeting a development project it did not like, and EPA remained frustrated in its attempts to operate a credible wetlands program.

During Reagan's second term, however, the Section 404 program began to operate more efficiently and effectively. With the scandal-ridden departure of Anne Burford from EPA, new leadership at both agencies fostered higher morale and a renewed commitment to wetlands protection. Left more or less alone, EPA and the corps began to settle the differences that had bedeviled them since the program's inception.

Frustrating as interagency squabbling had been to permit seekers, the prospect of EPA and the corps working harmoniously to protect wetlands was even more



Wetlands cover some 6 to 9 percent of the lower 48 states. Because oil-rich Alaska and Louisiana have the largest proportion of such areas in the U.S., oil companies take a particular interest in regulations restricting development on wetlands.

disturbing. Dam and highway builders, oil companies, and developers saw projects scrutinized more closely, modified more frequently, and, in a small fraction of cases, simply denied. Protests against wetland protection began to intensify.

In 1987, a group called the Wetlands Coalition for Procedural Fairness formed to address what it considered threats to future development. The group eventually metamorphosed into the National Wetlands Coalition, with members such as ARCO, BP America, Exxon, Kerr-McGee, and Unocal. Oil companies take a special interest in restrictions on wetlands development for two reasons: Alaska and Louisiana. To drill for oil in these wetland-rich states, companies must often obtain permits for the construction of access roads, drilling pads, and other facilities.

At the same time that special interests such as oil and construction began organizing against wetland protection, a number of developer-supported groups, such as the Pennsylvania Landowners Association and Maryland's Fairness to Landowners Committee, also entered the fray. Groups in the West, often positioning themselves under the banner of "wise use," began to champion the cause of mining, timber, and grazing interests. *High Country News* reports that People for the West!, which

proclaims itself a "grassroots campaign in support of western communities," has a board of directors in which 12 of the 13 members are mining-industry executives.

These groups maintain that the wetland program effectively takes control of private property without just compensation, as required by the Fifth Amendment, and often allege that the federal government prohibits all activities on wetlands. In fact, of the 90,000 activities regulated by the corps yearly, 83 percent are authorized by general permits, a form of expedited approval not requiring public notice or hearing. Less than 5 percent of all permit applications are denied, and even permit denial rarely deprives a landowner of all economic uses of a parcel.

In contrast to the National Wetlands Coalition, which speaks soothingly of its desire to protect "true" wetlands and bring "balance" to protection programs, some of the more aggressive groups promote private ownership of property as a right unfettered by considerations of the public interest. The Nature Conservancy quotes Ron Arnold, a prominent spokesperson for the Wise Use movement, as saying: "Our goal is to destroy, to eradicate the environmental movement. We want to exploit the environment for private gain, absolutely. And we want people to understand that this is a noble goal."

A Fragile Consensus

EPA administrator Lee Thomas sought to deal with the growing controversy by asking the Conservation Foundation to convene the National Wetlands Policy Forum, composed of state and local government officials, environmental organizations such as the Audubon Society and the Nature Conservancy, and agriculture, oil, and construction interests.

In 1988, after much debate, the forum published *Protecting America's Wetlands: An Action Agenda*, which contained some 100 recommendations for improving wetland protection. The best known of these was the forum's call for a short-term goal of "no net overall loss of wetlands" and a long-term objective of increasing the nation's wetlands base. Although the concept of "no net loss" had been floating among wetland regulators since the early 1980s, the report catapulted the idea into the forefront of environmental debate.

That a group as diverse as the forum could agree on anything, however tenuously, underscored the reality and urgency of wetlands loss. Although largely undefined, the slogan "no net loss" became the rallying cry for wetland protection. But the forum's consensus would prove to be paper-thin; the document on which it was based, like the Gospels, could support various interpretations. Although the vision of painless wetlands protection would not ultimately survive the hard test of reality, it was given new life by George Bush, who championed "no net loss of wetlands" in his 1988 presidential campaign.

Bush's new EPA administrator, William Reilly, was keenly interested in wetland protection. One of his first moves was to begin an action to veto a permit for the contentious Two Forks Dam on the South Platte River near Denver. Meanwhile, the relationship between the corps and EPA continued to thaw, and by the end of the decade the two agencies had settled several longstanding disagreements. The resolution of one key issue, however—the method of delineating wetlands in the field—unexpectedly boomeranged into a major controversy.

Wetlands are a continuum, in which plant life changes gradually from predominantly aquatic to upland species. Defining the exact point at which a wetland ends and upland begins is ecologically meaningless, although crucial from a regulatory standpoint. Property without wetlands does not require a fill permit from the federal government, and properties with small areas of wetlands are generally more easily developed than those with large areas.

Although the definition of wetlands has remained unchanged since 1977, the process for delineating wetlands in the field has been a matter of debate. The corps used a three-pronged approach, examining vegetation, soils, and evidence of surface or subsurface saturation, a method that proved surprisingly consistent. Meanwhile, EPA, the Department of Agriculture, and the Depart-



Roughly half the nation's wetlands endowment has been destroyed since colonial times. Although a Bush administration plan would have allowed landowners to create new wetlands when destroying existing ones, such efforts rarely work.

ment of the Interior each used its own approach, predicated on slightly different methods.

Little wonder, then, that the Wetlands Forum had recommended that environmental agencies "work together to develop consistent delineation methodologies." The agencies responded, and in January 1989 four federal agencies signed a single manual for delineating wetlands, expecting that this would make life simpler and less expensive for the regulated sector. The manual relied on the corps' three-parameter approach but allowed delineators to infer the degree of inundation or saturation from the presence of certain types of soils and vegetation. This made sense, since wetland soils and vegetation can be identified throughout the year, while direct observation of hydrology is time-consuming and seasonally dependent. The new manual did not, in fact, differ strikingly from the corps' 1987 manual, except in one key respect: the corps now mandated its use by all district offices.

In areas such as New England and California, where district offices had adopted the previous manual, the 1989 version essentially codified existing practice. But in other regions, the Southeast in particular, some corps offices had favored ad hoc methods that minimized the amount of land falling under regulation. In these areas, use of the 1989 manual brought more acreage under the purview of Section 404. Some field workers not trained to apply the manual accurately also wrongly inferred that the presence of any hydric soil automatically defined an area as a wetland, regardless of other indicators.



An outcry from the regulated sector soon reached the Bush administration and Congress. Farmers, developers, and other interested parties complained that the 1989 manual had suddenly expanded the reach of the program into areas that were not, in fact, wetlands. The *New York Times* reported that, as a result of the 1989 manual, 40 percent of California could be designated as wetland, a figure two orders of magnitude too high. The prize for the most outlandish statistic probably goes to the *Detroit News*, which stated in an editorial, "As currently defined, wetlands could conceivably encompass 70 percent of the United States."

As horror stories multiplied, it became nearly impossible to untangle truth, exaggeration, and complete fabrication. In some cases, groups never involved with the Section 404 program to any meaningful degree became convinced that it had become a major threat to their business. A national association of wool growers, for instance, adopted a resolution to that effect.

Some of the most virulent objections to the manual came from the American Farm Bureau Federation. Even though agricultural conversion has historically been the number-one cause of wetlands loss in the United States, the Clean Water Act exempts most existing farming and forestry activities from regulation under Section 404. In spite of these exemptions and without evidence that the program adversely affected any farming activities, the American Farm Bureau Federation helped scare its membership into believing that the 1989 manual represented a new and burdensome intrusion into their lives.

Even in retrospect, it remains difficult to ascertain how much of the reaction to the 1989 manual resulted from its actual impact, how much from genuine misunderstanding, and how much from deliberate misinterpretation. In any case, EPA and the corps exacerbated the situation by failing to acknowledge that the manual did, in fact, affect the delineation of wetlands in certain areas of the country. Nor did the agencies effectively

counter the deliberate distortions being spread. The failure of EPA and the corps to anticipate and forthrightly explain the effects of the 1989 manual helped the controversy to grow out of hand.

A Disastrous Plan

By early 1990 the consensus of the Wetlands Forum had evaporated. Now the White House set out to gain political control of the Section 404 program through two executive-branch entities: the Domestic Policy Council, whose membership consisted of the heads of various cabinet-level offices and which was headed by John Sununu; and Vice-President Dan Quayle's Council on Competitiveness, which aimed to give business relief from government regulations.

In the past, the White House had not tampered with the operation of the program as a whole, interfering only in particular cases with political implications. But political appointees began drafting revisions with the aim of reducing the area of regulated wetlands. This effort became increasingly unscientific: one appointee suggested cutting the number of plants considered wetland species in half, while another proposed limiting wetlands to areas with standing water at least 80 percent of the year. Vice-President Quayle offered his own Yogi Berra-like definition of wetlands: "How about if we say, when it's wet, it's wet?" In frustration, two of EPA's senior wetlands scientists ultimately disassociated themselves from the project.

A revised manual, drafted under the auspices of the Domestic Policy Council and the Council on Competitiveness, was proposed in August 1991 as part of the Bush administration's long-awaited wetlands plan. Entitled *Protecting America's Wetlands*, the plan presented a series of proposals ostensibly intended to "take a significant step toward the President's goal of no net loss of wetlands." Instead, it represented the Bush administra-



Wetlands control flooding by slowing the flow of water along both inland and coastal areas, and provide food, shelter, and breeding grounds for many rare and commercially important species of birds. Wetland plants also purify water by filtering pollutants and settling sediments.

tion's final abandonment of that fundamental promise.

The implications of the proposed 1991 manual alone are appalling. More than half of Virginia's Great Dismal Swamp, home to over 200 species of mammals, birds, and other vertebrates, would lose federal protection. Wetlands in states as diverse as Alabama (which would face a 50 percent reduction), Colorado (40 percent), Illinois (65 percent), Louisiana (33 percent), and Wisconsin (60 percent) would be devastated.

Field testing further revealed that the 1991 manual aggravated the very problems it was intended to correct. Its methods were not only more costly and time-consuming but the results were inconsistent, increasing opportunities for dispute. For instance, while the 1991 manual required proof of a certain number of days of flooding or saturation, it disallowed consideration of the most reliable indicators of prolonged wetness—the presence of characteristic plants and soils. As one field tester put it, he felt as if he were standing in a charred forest but could not conclude that there had been a fire unless he could see flames and smell smoke.

Of the roughly 1,000 scientists, consultants, and regulators who tested the manual in the field, more than 90 percent argued against its adoption. A number of states submitted detailed comments ridiculing the scientific and technical problems in the document and urging that it be withdrawn. The strong negative reaction and the damning field test results prevented the Bush administration from adopting the proposed manual; the change of administrations sealed its fate. By mutual agreement, EPA and the corps are relying on the corps' 1987 manual.

Besides suggesting revisions in the method for delineating wetlands—changes that would eliminate federal regulation over one-third of the nation's wetlands—the plan outlined measures to curtail EPA's role and proposed dividing wetlands into categories, thereby reducing much existing protection. The plan would have

dropped, in most cases, the requirement that a permit could be issued only for the "least environmentally damaging, practicable alternative"—a provision that has reduced unnecessary losses. Instead, it sought to establish a "mitigation banking" scheme under which permit applicants could barter away natural wetlands by promising to create artificial ones somewhere else, even in another state. The plan would have permanently exempted many created wetlands and 60 million acres of farmed wetlands from regulation, even if the land were subsequently converted to other uses. And regulations could be waived or weakened in states that have lost less than 1 percent of their wetlands—that is, Alaska.

Forces both inside and outside EPA and the corps voiced strong opposition to most of the plan's provisions. Wary of taking political risks as the presidential election grew near, the Bush administration did not press forward, and some key measures remain in a sort of bureaucratic limbo. Nonetheless, the administration succeeded in establishing new parameters that will in part shape the debate over wetlands protection under the Clinton administration.

A Dangerous Opportunity

Section 404 has established itself as a more valuable environmental program than could have been foreseen in 1972. One can travel to virtually every county in the nation and point to some environmental benefit from the section's provisions. Meanwhile, public appreciation of the importance of wetlands continues to grow.

Nonetheless, wetland regulation remains contentious. Representative Jimmy Hayes (D-La.), together with some 75 cosponsors, has reintroduced the Comprehensive Wetlands Conservation and Management Act, intended to curtail protection over most of America's wetlands. Both sides are also gearing up for a heated debate over wetlands protection during the reautho-

rization of the Clean Water Act. And a group of southern Democrats who favor weakening wetlands protection has called on President Clinton to convene a summit meeting on the issue. He has not yet responded, and, with key political posts as yet unfilled, has not set a clear direction for wetlands policy.

As the fledgling administration confronts this controversial issue, it would do well to study recent history. The experiences of the past four years contain several important lessons:

First, wetlands protection must be based on good science. Scientific and policy concerns are admittedly intertwined in most environmental issues. But under the Bush administration, policymakers decided not only how wetlands should be delineated but also that they could easily be ranked in value, and that new wetlands could be created to replace those that are destroyed. Most reputable scientists disagree with these conclusions. Many complex, site-specific variables influence the environmental value of a wetland, and major projects in low-value wetlands may cause greater environmental harm than minor projects in high-value systems. The record also shows that few mitigation projects work as well as advertised and some fail completely. Mitigation is no substitute for prevention.

Last August, Congress allocated \$400,000 to the National Academy of Sciences to study some of the technical issues related to wetland delineation. The results of this study, which will become available in late 1993 or early 1994, may help to depoliticize this key area.

Second, the time is ripe to revisit the basic structure of the Section 404 program, which has remained unchanged for more than 20 years. Although EPA and the corps have grafted layer upon layer of bureaucratic compromise and legalistic contortion onto the program, it remains unclear which agency should interpret key regulations; in practice, both do, sometimes with conflicting results. Resolution of especially controversial permit applications may be delayed—sometimes for a year or more—as one agency appeals the other's decisions.

Incremental improvements within the existing structure are possible, but sweeping reforms are needed to clarify the role of each agency in the permit process. One option would be to transfer permitting authority to EPA from the corps, with the latter retaining an advisory role on navigation and dredging. After all, EPA already handles the other major Clean Water Act programs. But this solution would create logistical problems, since the corps has 36 district offices while EPA has only 10 regional offices.

Perhaps the best approach would be to have corps permit decisions bound by EPA's determination of compliance or noncompliance with the 404 guidelines. Right now, although EPA has the power to write, change, and interpret the guidelines, the corps determines compliance on a case-by-case basis. All parties would save time

and money, since there would be no need for long drawn-out interagency permit appeals or EPA vetoes.

Critics of the Section 404 program have called for wholesale delegation of federal wetland regulation to the states. The more effectively states protect their resources, the less need for an intensive federal regulatory program. However, without a federal backstop, states may be forced to lower environmental standards as they compete to attract developers. And states have always had difficulty adequately regulating projects promoted by a state agency, such as highways. When a governor wishes to see a particular project constructed, the head of the state environmental agency often has two realistic options: acquiesce or resign. Few resign.

A better solution would be to adopt procedures that eliminate duplication but preserve the complementary aspects of state and federal programs. In New Hampshire, for instance, the old permitting procedure has been replaced with a more efficient approach. Activities that have minimal environmental impact according to state guidelines automatically receive federal approval upon receipt of a state permit. Those that affect three or more acres of wetland are subject to full review by federal agencies. Activities that do not meet either of these criteria receive an expedited preliminary screening to determine whether full federal review is necessary. In the past year more than 90 percent of proposed projects went through the automatic or screened approval. This system reduces red tape while ensuring adequate review of environmentally risky proposals.

Fundamentally, the protection of wetlands will remain a complex undertaking simply because it has to be carried out on a case-by-case basis, but the case-by-case approach has its limitations. Nearly everyone favors protecting wetlands, yet the environmental value of an individual parcel often seems expendable when weighed against the economic gains derived from jobs, profits, or private use. The result is that few particular proposals appear damaging enough to deny.

We must take a more ecologically sound approach. Just as we evaluate the hazards of smoking and not the ill effects of each single cigarette, we must assess permit decisions in terms of both individual and cumulative impacts. The current principle—under which permits are issued only for the least environmentally damaging, practicable alternative—is effective but difficult to implement. Hundreds of hours and thousands of dollars are spent trying to determine what alternatives can reasonably be considered economically feasible, and the geographic scope within which alternative sites might be located.

We propose a simpler principle: basing permit decisions on whether the public benefit from the type of activity involved requires the destruction of wetlands, not on the alternatives available to the applicant. For instance, rather than focusing on whether a particular developer can find an alternative site for a proposed shopping mall, we should ask whether the public bene-

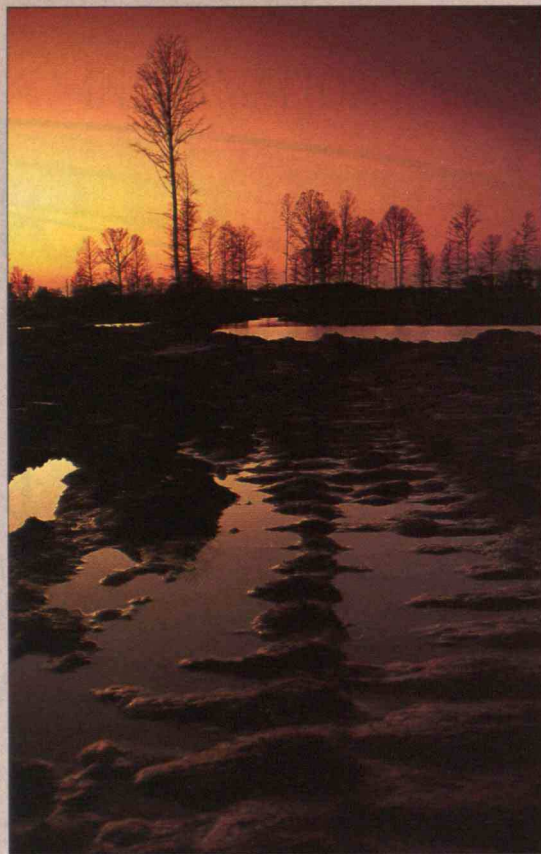
fit derived from the construction of shopping malls—employment, access to goods and services—can be achieved without destroying wetlands.

Such a principle would categorically deny permits for many types of activities on wetlands—including, we hope, the construction of shopping malls. Other activities, such as the building of marinas, do require access to water and could be weighed on a case-by-case basis. Permits could also be granted for projects that carry important community benefits, such as replacing a substandard bridge or constructing a road through a wetland to straighten a dangerous turn.

This regulatory framework would be more equitable than the current one, in which the corps may deny permits to developers who have the resources to choose less environmentally damaging alternatives but grant permits to those who do not. Some exceptions would have to be made—for instance, to allow development in a low-value wetland to protect a more environmentally valuable upland site. But in general, this principle would solidify the relative priority of wetlands protection and halt the incremental losses that are steadily eroding our remaining endowment.

Finally, the shape of national wetlands policy will be determined by the nation's ability to reconcile its ambivalence about the regulation of activities on privately owned property. A 1992 Times-Mirror poll found a majority of respondents felt that wetland protection should take priority over property concerns. Nonetheless, a significant portion of the public remains troubled by what it sees as growing government infringement upon the rights of property owners. These citizens argue that wetland regulations and even zoning requirements force landowners to sacrifice for the public good. Just as landowners must be compensated for property seized by eminent domain, the argument goes, so should these losses be compensated, even though no physical taking of property occurs.

So far, the courts have not looked favorably on these claims. One recent decision, *Lucas v. South Carolina Coastal Commission*, indicates that the current U.S. Supreme Court will generally find a compensable "taking" has occurred in the uncommon circumstance



To stop the incremental loss of wetlands, we need a permit process that takes into account the cumulative effects of development.

where a regulation has proscribed all economically viable uses of a parcel. A permit denial may prevent some uses on the entire property or all uses on some part of the property but rarely denies all uses on the entire tract. Moreover, the court left open the possibility that even a total deprivation of use would not be compensated. Litigation on this issue will undoubtedly continue through the remainder of the decade.

Politicians may be willing to go further than the courts in forcing the government to pay for restrictions on private property use. The 1992 Republican Party platform, for instance, stated: "We will require federal agencies to promptly compensate, from their own budgets, for any taking of private property, including the denial of use." If compelled to pay off every applicant whose permit is denied, government agencies might find wetland protection just too expensive.

We believe denials of wetland fill permits do not represent seizures of private property but rather are decisions designed to prevent public harm: flood risks, degradation of surface and groundwater, and damage to commercial and sport fish and wildlife stocks. The government may be able to insulate itself from some challenges by arguing that restrictions that prevent a nuisance cannot constitute a taking.

Property rights have always been tempered by limits on the extent and nature of development. Holding title to a property does not invest the owner with the right to create a nuisance or put the land to a noxious use. The government has no obligation, in essence, to pay its citizens not to pollute the environment or destroy valuable public resources.


In formulating national wetland protection policies for the remainder of the decade, the new administration falls heir to a complex and contentious issue. The Chinese language has a character to represent such situations that translates roughly as "dangerous opportunity." Having lost over half the nation's wetlands, will we adequately protect those that remain? Or will we, on the altar of "balance," allow many small decisions made in individual self-interest to lead to the eventual sacrifice of a priceless natural resource? ■



INFORMATION HIGHWAY: The Home Front

By HERB BRODY

The communications and entertainment industries hope to use new technologies to make TV as interactive as the computer and as friendly as the telephone.



YOU'VE heard the litany: Soon it will become possible to watch a missed TV show later in the week, even if you forgot—or were unable—to program your VCR to record it. And you'll be able to view any of thousands of movies at any time of the day, without having to wander out to the local video rental store. You'll also be able to shop for groceries, inspect real estate, and play video games with people from all over town—all without exercising more than your remote-control finger. In fact, the TV set is going to become a window into a vast array of interactive

ILLUSTRATIONS: DIANE BIGDA

services, made possible by the extension of technologies that enable the transmission of huge volumes of data needed to represent moving pictures.

But wait a minute, you say: Why should I believe it this time? Haven't technologists been making these kinds of promises since the 1970s? And hasn't it all turned out to be so much vaporware—grand ideas that have failed either because of technological infeasibility, the nonexistence of a market, or regulatory barriers?

That was then. In the past ten years, telephone companies have laid tens of thousands of miles of optical fiber, with an information-carrying capacity, or bandwidth, greatly exceeding that of the copper wire it replaced. Technologies have arisen that bestow fiber-like capability on the existing network of copper wire and coaxial cable that reach into homes. In a parallel development, advances in digital "compression" technology have drastically reduced the number of bits required to represent a video signal. The combination of high-capacity transmission lines and compressed signals should multiply manifold the amount of information that can be piped into the home. Cable operators will be able to offer hundreds of channels and phone companies will be able to send TV images through ordinary phone lines. A tidal wave of pictures and sound is about to crash into our living rooms.

Technology aside, changes in the regulatory landscape are encouraging the development of new services. Restrictions against phone companies offering information services have been partially lifted. At the same time, new regulations that restrict how much cable TV operators can charge for basic service will probably tempt the cable companies to seek profits in a variety of not-so-basic-offerings that exploit the hundreds of additional channels made possible by fiber optics and digital compression. The question of consumer demand remains, but field trials around the country are attempting to find out what people want and how much they are willing to pay for it.

Through the fog of confusing claims and breathless promises, the outlines of a nascent medium are becoming visible. The television set will occupy center stage, as it does now, but viewers will be able to control what comes on their screen with the agility now enjoyed by users of personal computers. That's no accident; as electronics prices have plummeted, TV makers have begun stuffing the once dumb appliances with computer chips. Services—which will range from hit movies to interactive, animated shopping catalogs to multiple-player video games—will enter the home either through the telephone line, the TV cable, or maybe both.

Despite this flurry of activity, the lofty images of a national information network, such as that advocated

by Vice-President Gore, are not in immediate evidence. Proponents of the new high-capacity technologies have stressed the ability to tap into vast databases—for example, translating the entire contents of the Library of Congress into digital form and making it available online. What is emerging, however, has less the character of a highway than a strip mall, focusing on services with proven consumer demand that can rapidly pay for themselves (see "*Beyond Inter-Passive Media*," page 69). None of the TV-based services announced so far will satisfy the true information junkies, who will have to continue using a personal computer and modem to tap into online databases.

Also conspicuously absent from most discussion of new home information services is the one technology that has excited technologists and politicians more than any other: high-definition television. The omission is significant. HDTV is, after all, despite its engineering challenge, a stunningly small-minded advance. All it does is produce bigger, sharper pictures on the TV.

This is not to say that we'll be stuck with the fuzzy, low-definition pictures we've been watching since the days of *I Love Lucy*. In fact, because competing U.S. developers of HDTV agreed this spring to a digital transmission format, high-definition TV broadcasts may start as soon as 1995. But the more fundamental benefits of the burgeoning network will come not from sharpening up the picture but from offering consumers more choices and convenience. The movement toward interactive services provides evidence that the new powers of digital communications will serve not merely to polish an ancient artifact but to create a new medium.

Who Ya Gonna Call?

Several industries are competing—and sometimes flowing together—to create the new wave of home information services. Each industry has its technological strengths and weaknesses, as well as its own motives for entering the business. Telephone companies already have a wire into the vast majority of U.S. households. They also have built a vast, interconnected network that carries information in milliseconds between virtually any two points on earth.

The judicial ruling that broke up the Bell System in 1984 ordered the regional operating companies that resulted—NYNEX, Bell Atlantic, et al—to be only carriers, not producers, of information services. A 1992 modification of this ruling permits the regional monopolies to offer such services, but only outside their monopoly territory. NYNEX, for instance, is allowed to offer a service in Philadelphia but not in Boston or New York. Bell Atlantic is pushing for greater relaxation of the ruling, seeking to provide its customers with programming over a new interactive video service it is

installing *within* its territory, in Alexandria, Va.

Cable television operators lack this pervasive network, but they have something the phone companies do not: a time-tested technology for delivering video into the home. Cable providers are thus building fiber-optic lines that carry programming into a single point in a neighborhood of a few hundred homes. Dozens of video channels can be transmitted through this fiber, and then the last mile or so to the home through conventional coaxial cable. (For short hauls, coaxial cable can match the information capacity of fiber.) This approach, the cable industry claims, is tantamount to—but far cheaper than—stringing fiber into every home.

The law passed by Congress last year re-regulating the cable TV industry shapes the strategies of cable system providers. With this law decreeing a limit on how much the cable companies can charge customers for “basic” services, the cable operators are seeking to establish a presence in the lush, unregulated territory of enhanced services. According to the official industry position, limits on basic rates will inhibit the ability of cable companies to develop these advanced services. But the welter of activity from the big companies suggests no such inhibition. Cablevision Systems, for example, is building a \$300 million cable “superhighway” on New York’s Long Island that will offer its 1.1 million subscribers wide choices of entertainment, shopping, and home banking services.

Time Warner Cable is planning to set up similar “full-service video networks” for its subscribers. An early version of such a network has been operating in Queens, N.Y., for the past two years, and a full-blown network is being installed in Orlando, Fla. The deployment of these networks got a huge boost when US West, one of the regional phone companies, agreed in May to pay \$2.5 billion for 25 percent ownership of Time Warner Entertainment, which owns the cable operation. Time Warner says it will use \$1 billion of this money to accelerate the deployment of full-service networks in a number of other cities, which Time Warner will not identify.

The company also talks about “distance learning.” Students throughout a city, for example, might be able to tune into a physics lesson, say, from the region’s most talented teacher. Kids could also use such a network to request homework help from their teachers, or from fellow students. The ability to take classes from home could be a godsend to adults attempting to further their education while balancing work and family obligations.

While such educational visions often make the list of promised services, entertainment offerings will, in the near term at least, fill most of the new cable channels. In all the tests announced so far, the flagship service is some version of video on demand—essentially an elec-



New technologies
will open up hundreds of
additional television channels—
but most of them will
at first be devoted to
a few hit movies.

tronic video store. Using their remote control, customers browse through an on-screen list of available movies, and select one to view.

In the purest form of such a service, the movie would start showing right away and viewers would be able to pause and rewind, just as they do when watching tapes on a VCR. This capability requires that the video signal be transmitted to a buffer memory, which could be located either in a set-top box or at the service provider's facility. To watch the movie, the picture and sound signal would be drawn out of the buffer and displayed on the screen. Such an arrangement would make it relatively easy to pause and to back up, say, to listen again to a crucial piece of dialogue.

But so far, most cable companies are talking instead about a poor cousin called "near" video on demand. The cable company sets aside a block of channels to continually transmit the dozen or so most popular movies—the ones that account for 80 percent of the rental business. The system might dedicate 200 channels to the top 10 movies, with starting times staggered by about 5 minutes—the film starts at 9:00 p.m. on channel 101, 9:05 on channel 102, 9:10 on channel 103, and so on. When the viewer requests a movie, the TV set tunes itself to the channel on which start-up is most imminent.

The viewer can pause the broadcast, just like watching a tape, but it will not in general be possible to resume at exactly the same place. When you want to resume watching, the system will display something like this: "You paused at minute 27. Click at your desired point of re-entry: Minute 10, 15, 20, 25. . ." This allows a crude form of rewinding and fast-forwarding. The more channels the cable operator devotes to a particular show, the better controlled your access to it will be. But even with hundreds of channels, a cable system could continually retransmit only few hit shows—hardly the boundless variety that the technology makes possible.

Calling All Phone Companies

While some 65 percent of U.S. homes have cable TV, more than 90 percent have telephone service. Unlike cable TV systems, which are telecommunications islands serving a particular community, the phone network is massively interconnected and could thus offer its customers a much broader choice of material. We take for granted the capability to pick up a phone and call someone across the country or around the world. Similarly, a computer in the phone-company switching office could retrieve movies, software, or games from "any hard drive in the world on any computer in the world," says Alexander Gelman, a multimedia researcher at Bell Communications Research, or Bellcore—a research consortium supported by the telephone companies.

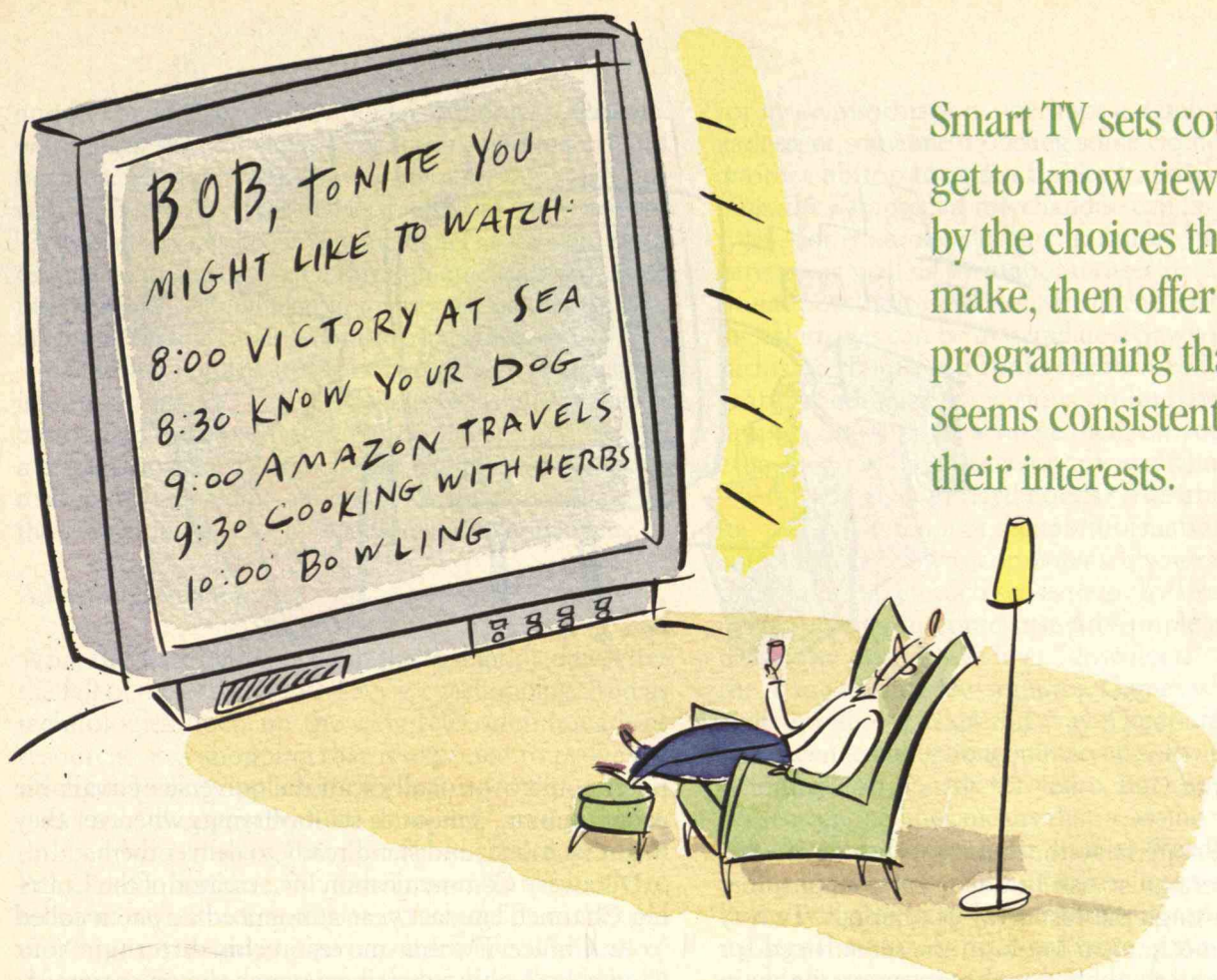
For the past decade, enthusiastic phone company executives and industry analysts have touted such capabilities as the pot of gold at the end of the fiber-optic rainbow. Only by running fiber all the way into every home, the conventional wisdom held, would it be possible to deliver high-quality video. Alas, except for scattered demonstration projects involving a few thousand homes, the coming of fiber has been repeatedly postponed. Running fiber to every home would cost billions of dollars, and until recently the phone companies have not come up with any plausible ways of recovering that cost with additional revenue.

Fiber's chief advantage is its ability to transmit very large volumes of data. Most significantly for homes, this capacity means the ability to carry video, which requires at least ten times the bandwidth of voice. In the last year, however, Bellcore has developed an approach that permits video transmission through the ubiquitous copper wires that already enter homes. The technology is called ADSL (asymmetrical digital subscriber line), and it allows an ordinary copper telephone line to carry a high-speed digital signal while simultaneously transmitting a voice conversation.

The key idea of ADSL, as the term asymmetrical suggests, is to transmit the high-speed data stream only in one direction: from the central switching office to the home. This represents a radical departure from standard telephony. Practically since its inception, the phone system has offered "full duplex" transmission; in other words, phone users can transmit the same kind of signals that they receive, and at the same time. You don't have to wait until the other person pauses before you speak.

Video, however, would impose far more difficult demands on such full duplex transmission, and the ability to send video *from* the home is not yet really needed. ADSL is, then, a sort of tactical retreat. By not maintaining the full duplex capability that has defined telephone service since its inception, phone companies can begin to deliver video-based services to homes in the near term—without waiting for the fiber optics that will allow a two-way line.

ADSL permits transmission at 1.5 megabits per second through up to 18,000 feet of standard copper telephone wire. With available signal-compression technology, such a data stream can deliver a television picture with quality indistinguishable from that produced by a typical VCR. About 80 percent of U.S. households fall within an 18,000-foot radius of a telephone switching office, according to Bellcore's Gelman. AT&T plans to conduct a market test of the technology next year in Castro Valley, Calif. (near Oakland). As further evidence of the cross-industry alliances that the new technologies are fostering, AT&T will team up in this test with Viacom International—the operator of multiple cable systems with a total of 1.1 million subscribers.



Smart TV sets could get to know viewers by the choices they make, then offer them programming that seems consistent with their interests.

Life with 500 Channels

The same advances in digital compression that make ADSL feasible also underly the sudden proliferation of cable TV channels. In its standard form, a full-motion, color television signal requires a channel bandwidth of about 6 megahertz. Today's cable systems can accommodate about 50 such channels. But digital technology makes it possible to squeeze the picture into much less than 6 megahertz without appreciably altering the way it looks.

Typically, the system will transmit a code that indicates only how each frame differs from the one before it, as opposed to retransmitting the entire frame. A similar approach can reduce the number of bits needed to represent each frame, since in many scenes each pixel is pretty much identical to its neighbor. Such measures can compress a video signal by a factor of 8 or 10, and potentially by much more. Thus the system can handle several hundred channels without laying any additional cable.

Although such compression schemes have been around for years, the plummeting cost of digital electronics has now made them commercially viable. Another boost to compression technology has come from the adoption of a standard, formulated by the Motion Pictures Expert Group. The MPEG standard does not specify *how* to compress a signal; in fact, it

allows companies to develop competing proprietary algorithms. But MPEG does stipulate the precise format the compressed signal will take. By inscribing this Rosetta stone of compression, MPEG has removed a major obstacle to the technology's widespread use.

Different kinds of programming will require different amounts of compression. Material originally produced on film is somewhat more electronically concise because of its 24-per-second frame rate, as opposed to video's 30-per-second. Also, films tend to have less movement—if a movie picture were as frenetic as a TV's, people would find the big screen difficult to watch. Hence the first offerings of video-on-demand will be largely from film. Video-based programming, such as news, sporting events, and sitcoms, requires more abbreviation at the signal and so lags behind the filmed material.

The cable industry is staking its future on compression. Telecommunications Inc. (TCI), for example, whose 10.2 million subscribers make it the country's largest cable company, has ordered 1 million digital converter boxes—the set-top units that will decompress the signal and make possible 200 to 500 channels. The company will begin installing the units nationwide next year, says spokesperson Lela Cororas, and hopes to put them in 90 percent of its customers' homes during the next three years.

In contrast to today's chatty purveyors of cubic zirconium, home-shopping services will show viewers exactly the products they ask to see.



Surfing Wipeout

Delivering the material to the home is only part of what is needed. There must also be a way for the consumer to navigate through the vast array of offerings. Twenty years ago, a mechanical knob on the set sufficed for selecting among the half-dozen stations available in most homes.

But the "channel surfing" that works with today's systems of a few dozen offerings will be inadequate for browsing among the multitude of options that digital compression and fiber optics will make available. Even assuming hyper-grazing at two seconds per channel, it would take about 15 minutes to cycle through 500 channels. The more numerous the offerings, the more sophisticated the interface will have to be.

In fact, the whole idea of a "channel," as defined by the disseminator of programming, begins to lose its value. Most of us throw away—that is, don't watch—almost all of what comes over the cable. This is like having a thousand magazines delivered to your home every day, and then discarding all but the few you really want to read. Such a wasteful practice will become unnecessary once most programming is in digital form, says Andrew Lipmann of the MIT Media Laboratory. A channel will become not a band of frequencies but rather a customized subset of information and entertainment categories. Each individual could establish his or her own channels. A TV set equipped with digital memory and intelligent software could get to know viewers by the choices they make, and then continually offer them new material that seems consistent with their interests. Say, for example, that someone repeatedly requests science-fiction movies. The television's com-

puter could continually scan the universe of available programming, announce sci-fi offerings wherever they might be found, and stand ready to deliver them.

Discovery Communication Inc., creator of the Learning Channel, late last year announced a system called Your Choice TV that moves in this direction. Your Choice lets cable subscribers watch the most popular TV shows at their convenience rather than when they are broadcast. Say it's Tuesday and you want to see last Sunday's *60 Minutes*. Your Choice provides onscreen menus of all the past week's programming, organized by day and by genre. To get *60 Minutes*, you'd first click on "Sunday," then "news." *60 Minutes* would be one of a few options on the menu that would then be displayed. Click on the "go" icon—in a few minutes you'll hear the show's trademark tick-tick-tick.

The development of a better TV interface is also prompting activity from the mavens of user-friendliness at personal computer and software companies. Apple has set up a personal interactive electronics division (that's right, Apple PIE) to develop consumer multimedia products. Home information services could complement Apple's Newton—a hand-held "personal digital assistant" that combines the capabilities of a computer, fax, calculator, and phone. In fact, Apple has joined with three of the Baby Bells—BellSouth, Ameritech, and US West—to develop home information services that would require an Apple product in the home. The system being developed by Ameritech, for example, would alert the subscriber that a fax or voice message was waiting. The user would then retrieve the message or fax with the Newton.

Microsoft is marketing an abridged version of its popular Windows software that gives a television the look

and feel of a PC. Called "Modular Windows," the software fills a state-of-the-art TV screen with menus and buttons. Modular Windows is not a service itself, but rather an interface that makes it easier to use whatever TV-based services become available. The viewer uses a remote control to navigate through an electronic sea of information—scanning program listings, selecting shows, browsing on-line catalogs, or ordering goods.

Computers on the network could store a variety of interface software. This means a viewer could request a customized look and feel just as he or she could request a certain movie. One person may like the way a Macintosh computer presents choices, while another may prefer the simpler interaction of an automatic teller machine.

Adventures in Shopping

What did East Berliners do in the first giddy days after the fall of the Berlin Wall? They went shopping. And as technologies open up the new telecommunications resources, it is shopping that is expected to prove the most compelling application for many people.

In fact, "shopping without dropping," as it has been dubbed by technology analyst Paul Saffo, director of Palo Alto's Institute for the Future, seems likely to become one of the first services to emerge from the void of a large information pipe into the home. The reason: shopping services can pay for themselves. Providers of home shopping services "can count their money as they go," says Michael Worth, professor of mass communications at the University of Denver. It's easy, he notes, for the cable operator or phone company to take a piece of every sale made through the network.

Home-shopping channels already on cable TV (mainly QVC and the Home Shopping Network), and on late-night broadcast TV, put out a steady stream of product commercials, inviting viewers to place orders through an 800 number. But although the on-screen parade of goods might occasionally turn up something interesting amidst the cubic zirconium, it is hardly an efficient way to shop. This is like sitting in the parking lot at the mall as vendors march past, single file, with wagonloads of products and a credit-card plate. At best, these channels schedule presentations that focus on generic product types. The program guide issued by QVC lists hour-long blocks devoted to "collectible dolls," "ideas for the cook," "necklaces," and "gems galore," but that's as specific as it gets. And it is not at all personalized; the same programming comes to every home at the same time.

Picture the way it could be. Hit a button on your remote control, and the TV screen fills with a list of stores and catalog merchandisers. Proceed through layers of menus to specify what you want with more precision. When you see what you want, press a button

for more information—perhaps a demonstration of a gadget, or someone modeling some clothes. Finally, hit another button to order. Unlike traditional TV shopping, the database of merchandise can be organized by type—for example, clothing, furniture, tools, and groceries—as well as by manufacturer or retailer. Additional possibilities emerge from the ease with which digital images can be manipulated. Say you're trying to furnish a room. You could electronically snip photographic images from various on-line catalogs—sofa, drapes, carpet—and arrange them on your TV screen, even programming the color any way you want.

And why stop at hard goods? The ability to pump high-speed streams of digital information into homes could change the way computer software is sold as well. It doesn't make much sense to go to a retail software outlet when you could instead sample a program at home and then, if you like, "download" it, along with the manuals, in a few minutes. Games would be especially good to market this way. Computer enthusiasts have been fetching noncommercial software in this way from bulletin boards for years. But the low speed of present phone lines means that it would take hours to retrieve a popular program such as WordPerfect.

The high-speed communication lines feeding into the home will also be able to transmit compact-disc-quality digital audio. As with software, vendors could give potential customers a free trial listen. If satisfied, a person could order the recording transmitted and simple equipment at home could save the digital audio on a disc or tape for future replaying.

Video can also create an enhanced Yellow Pages. In Loudon, Va., for example, Bell Atlantic is demonstrating a video directory of doctors. You choose from a list on the TV screen, and the doctor appears giving a pre-recorded talk, not unlike some dating services. Similar systems could work for a variety of goods and service providers.

A greater variety of participation will be possible with a new device developed by TV Answer. The TV Answer box, which plugs into the television like a VCR, will transmit viewers' responses by radio waves to a local switching center and relay it by means of satellite to the company's offices in Reston, Va. A football fan watching a game on a set equipped with TV Answer, for instance, might be invited to predict the next play. The remote control will move a cursor on the screen to boxes labeled "run" and "pass." At the end of the game, viewers with a certain number of correct calls might be given some sort of prize.

TV Answer also could be useful for opinion trackers. The system will be able to handle 22 million responses within 14 minutes, says TV Answer spokesperson Paul Sturiale. A local news anchor might, for example, begin a broadcast by presenting a question, such as, "Should the city privatize its fire department?" By the end of the

broadcast the results would be available—and no one would have gotten a busy signal (the fate of millions who called a network in 1992 to give their views on President Bush's State of the Union speech). Of course, issues of equity always dog the introduction of such technologies. TV Answer, for example, expects to charge \$500 for the set-top box that will let a person "vote" on an issue; the skewed population of people who can afford such a gadget must be considered when looking at any such poll.

But "dollar votes" would be less discriminating. Advertisers could invite viewers interested in the products displayed during a commercial to hit a key on TV Answer—either to request more information or to purchase the product. To facilitate such a service, owners of a TV Answer unit will have to program in such personal information such as address, credit card number, or bank account number.

What Do People Want?

Big companies are putting big money into the coming transformation of television. But if they think they know what people are really going to want to pay for, they aren't telling. In fact, the main purpose of the current round of trials appears to be not so much to test the technology—as to gauge consumer reaction.

TCI, for example, in collaboration with US West and AT&T, is conducting a video-on-demand market test in Littleton, Colo. The test separates subscribers into two groups. Each will first be offered near-video-on-demand, and then "true" video-on-demand, with the ability to start watching any of 1,000 titles at will. TCI wants to see how deeply into the video library customers will delve. At most video-rental stores, about 20 percent of the tapes generate 80 percent of the revenue. Will that be true for video-on-demand as well? If so, a cable operator could devote a larger number of channels to these hits, diminishing the delay between request and start of showing.

A key question is how much people are willing to pay. Is an outing to the corner video shop such an onerous chore? According to some analysts, people don't seem to mind *going* to the video store to shop for tapes. What they do mind is returning them. They postpone this task so routinely that 20 percent of the video rental industry's annual revenues of \$12 billion comes in the form of late charges for overdue tapes, according to the University of Denver's Worth.

Ordering up a movie electronically avoids this task. It also removes the common frustration of going to the video store and not finding what you want. In fact, typical consumers say they would pay a premium of as much as 30 percent over a standard tape-rental fee if they could choose from a large selection of movies with-

out having to leave their house, according to Walter Miaow, vice-president for technology at the market research firm Link Resources in New York.

Still, most cable and phone companies say they are working on the assumption that they will be able to charge video-on-demand customers only a small premium, if any, over video store prices. That's a prudent approach, says August Grant, a professor of communications at the University of Texas in Austin and a specialist in audience behavior. "There's a ceiling on the percentage of their real income that most people will spend on entertainment," Grant maintains. Consumers are probably willing to pay a total of \$35 to \$40 per month on entertainment, estimates Martyn Roetter, vice-president of the market research firm Decision Resources Inc.

Economics aside, purveyors of home services will have to surmount cultural barriers. For example, Grant argues that the teenagers and young adults who constitute a large portion of the movie-going public use theaters largely as a social destination. The living room cannot fulfill the same function. Similarly, home shopping services must account for the sociability that makes shopping so appealing to many people. Today's home shopping channels reflect an understanding of this phenomenon; they don't simply offer a screen of products, but also provide lots of interviews and chatter.

Assessing the market for video-on-demand is the easy part; there is, after all, a close functional analog in place already. But, how much will people pay for the ability to control the camera angle in a basketball game? For the privilege of requesting a test-drive by clicking on a box in a Ford Taurus commercial? For the flexibility of watching last week's episode of *Northern Exposure*? For the sense of civic participation that might follow from joining a national poll on some national policy issue?

For a service to attract a market, it will probably have to cost "significantly less than a large pizza," says Wendy Sanko, director of business development for US West Communications. "Services should be inexpensive enough that people will be able to experiment with them—no more than \$5 to \$10 a month," she figures.

Miaow of Link Resources says that consumers in focus groups say they would pay \$4 to \$8 a month for a service that gave them choice of multiple camera angles during a live event. Other desired services that have appealed to focus groups—albeit with no price tag attached—are interactive games, first-run movies, and multimedia informational packages (such as encyclopedia-like articles with moving, talking pictures).

But there are potential inconsistencies between what people say they would buy and what they actually buy. Consider online games, for example. In principle, people will be able to order up a never-ending stream of games through the high-speed digital network. In fact, as the network reaches into more and more homes, it will



By making “channel surfing” impractical, the proliferation of TV choices will force the development of new, more computer-like user interfaces.

make possible a new type of electronic game playing that involves many people at once. A “flight simulator” type of game, for instance, could engage dozens of people simultaneously; each would be piloting his or her own aircraft, and the movements of all would be visible on everyone else’s screen.

But any game that requires concerted participation by strangers will be difficult to arrange. The more games there are to choose from, the more difficult it will be to round up a quorum to play any one game at a particular time. Simply shouting the electronic equivalent of “does anyone want to come out and play” into the local cable TV or telephone network may not rouse a quorum. And the more the selection of games widens, the more difficult it will become to put together an ad hoc group to play.

Online game playing also faces a serious marketing obstacle. Game players today are accustomed to lengthy sessions; they refine their abilities bit by bit, learning the game’s idiosyncrasies and pitfalls by repeated trial-and-error at no additional cost. But in an online system, the meter will be ticking. Whether charged by the game or by the minute, players could no longer enjoy the open-ended sessions that have proved so compelling with stand-alone units.

Participants in a game-playing network must have set-top converter boxes that speak the same language. In a giant step toward such compatibility, TCI, Time Warner, and Microsoft have agreed to collaborate in setting the technical standards for interactive TV. Existence of such a standard should accelerate the development of consumer services.

Investing in a New Medium

The services promised by phone and cable companies will not be without competition. Video-on-demand con-

stitutes a direct attack on the videotape sale and rental industry—a business that has in the last 10 years grown from zero to \$12 billion a year. Most people live within a few minutes’ walk or drive of a video store. Large chain stores, such as those operated by Blockbuster Entertainment, carry 8,000 titles—more than what is so far available on any video-on-demand service. Blockbuster outlets in Queens, N.Y., have “not suffered a bit” from the introduction of Time Warner’s service, asserts Wallace Knief, Blockbuster spokesperson. Even once video-on-demand becomes the norm, a company like Blockbuster could stay in business by supplying programming to the telephone and cable companies that transmit into the home.

But the thousands of mom-and-pop video stores that have sprouted on every street corner, which cannot afford the large inventories of a Blockbuster, will be hard pressed to compete with video-on-demand. Also vulnerable will be the premium cable channels that deliver mainly movies, such as Home Box Office. “Video-on-demand will have a severe impact on a station like HBO, which runs a lot of filler,” says Decision Resources’ Roetter.

A key factor in the potential success of the online services is the role of the information providers. Movie studios, for example, now typically release films first to theaters, then to videotape, then to cable television. Where will the “window” be for release as video-on-demand? The earlier in the cycle, the more consumers will be willing to pay. Recognizing this, TCI recently paid \$8 million to the Carolco movie studio for the right to broadcast the next 10 films as pay-per-view events on cable *before* their theatrical release.

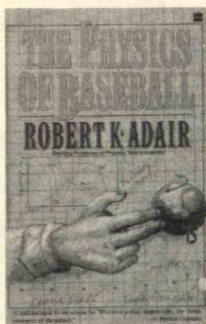
Similarly, high-quality home shopping will require participation by a large number of well-respected merchandisers and manufacturers. For a clothing company such as Land’s End or a gadget marketer such as

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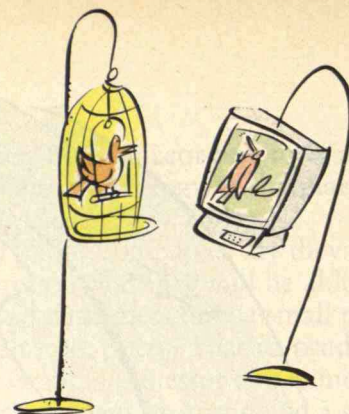
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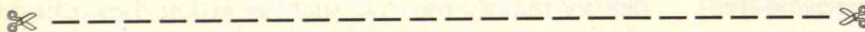
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Sharper Image to invest in converting its print catalog into a moving, talking, user-friendly TV presentation, the company must first be convinced of a payback. At least one retailing giant, apparently, is willing to take the plunge: In May, R.H. Macy & Co.—owner of the famed Macy's department stores—announced that it will start its own cable TV channel in 1994.

But basing a service's viability on the willingness of existing information providers to participate might miss the point. The digital network—whether it is maintained by telephone companies, cable companies, or some hybrid of the two—represents a precious new resource. It should attract information-service entrepreneurs the way the advent of personal computers spawned a multibillion-dollar PC software industry comprising, for the most part, new companies. Whether or not today's catalog merchandisers catch on to the new demands of online shopping, new and computer-savvy enterprises will certainly get into the act.

If the first offerings of the grand information highway fall short of inspirational, take comfort that most media need years—sometimes decades—to begin fulfilling their potential. And the telecommunications industries that are delivering the bevy of new services are in this for the long haul. "One thing we know," says the University of Denver's Worth, "is that these companies have deep pockets. They can afford to take some risks." ■



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Cover photo by Paula Lerner



ALUM- NEWS

ProNet: Job Hunting Made Simple

So you're an engineer looking for a job. Maybe your company is seeking technical or managerial help. Or perhaps you're satisfied with your job but want to keep abreast of openings in your field. Like the rest of the world, you can spend Sundays with the classifieds, sign up with a headhunter, and network till you drop. But as an MIT alumnus or alumna, you also have another option: sign up with MIT ProNet. ProNet links firms needing high-caliber employees with graduates of a select handful of universities, including MIT.

ProNet originated at Stanford University in the late 1980s, in response to a survey showing that career-related services were the highest priority with its alumni/ae. Mark Jordan, who is now the president of ProNet, was the marketing consultant who helped Stanford develop the service and also oversaw development of the database software. He says that the company's pilot phase demonstrated that its priorities should be serving alumni/ae interests, preserving confidentiality, responding rapidly to both alumni/ae and subscribing companies, and providing accurate, detailed information on potential hires.

When the expanded version of ProNet was officially launched in 1989, the Stanford Alumni Association had already brought on board MIT and the University of California/Berkley. They have since invited other universities to buy stock and join the company, so that now the alumni/ae associations of 13 universities own ProNet and sit on the board of directors. In addition to the original three, members include UCLA, Carnegie Mellon, Caltech, Columbia, Yale, Cornell, and the Universities of Chicago, Texas, Illinois, and Michigan.

ProNet's database profiles approximately 27,000 people, some 5,000 of

them from MIT. Half of those in the database have more than 10 years of work experience, and more than a third are executives in upper-level positions. More than 77 percent hold advanced degrees. And over 90 percent are not actively in the job market.

ProNet's subscriber companies come from industries such as software and computer design, telecommunications, health care, biotech, banking, finance, and consulting firms. They range from startup firms to Fortune 500 companies. Jordan says ProNet will be looking to increase its activity in medicine and law and is also exploring the opportunities to work with alumni/ae and companies outside the United States.

"One of the real changes we've seen," says Jordan, "is the move from having a small number of large corporations [as subscribers] to many small companies requesting searches."

William Hecht, '61, executive vice-president of the Association of MIT Alumni and Alumnae and chair of the ProNet board, notes that large companies require ProNet to work through the personnel office. Particularly in these uncertain economic times, personnel officers are often reluctant to spend company resources. In small companies, run by officers wearing many hats, it is easier for ProNet reps to make their case directly to the people who make financial decisions.

ProNet doesn't charge per placement. Rather, companies purchase a time-based contract that allows them a certain number of searches per year. Subscription rates for companies range from \$2,500 to \$12,000, depending on the size of the company and the number of searches anticipated.

Hecht notes that ProNet came along at just the right time for MIT. The Alumni/ae Association needed to offer more career services, and for what it would cost to hire and outfit a good personnel person for one year, the AA could join ProNet permanently. And, because ProNet caters mostly to high-tech com-



The MIT Club of Boston's Science Auction at the Museum of Science was a big hit, thanks in part to tireless organization by co-chair Jorge Rodriguez, '60. The historic piece of furniture he's holding up for bidders

still sports the steel bands that Doc Edgerton installed when he rescued the chair from the trash for use in Strobe Lab, and it went for \$250. Institute faculty and administrators, costumed and bewigged as "the top 10 men and

women of science and technology," helped establish the mood of fun leavened with a concern for science education. The event raised \$20,000 for the coffers of MIT's Council on Primary and Secondary Education.

panies, Hecht says, it's particularly suited to MIT graduates. The Institute is now the second largest participant.

ProNet in Action

How does the service work? When a company indicates that it needs a search, a ProNet search coordinator calls to discuss the requirements of the position with the line manager and company recruiter. The coordinator then searches the database for people with the appropriate skills and background and calls them to discuss the position and assess their interest. The profiles of alumni/ae who are interested in proceeding to the next level of the search are then forwarded to the company. Once the company decides which alumni/ae it would like to interview, ProNet releases the necessary contact information and notifies the alumni/ae involved.

Stefania Calabi, '76, was the chief operating officer at Intranet, Inc., when ProNet first approached her as a potential customer for the system. She thought the service was too expensive, so she decided not to use it. A few months later, she was approached again, this time with a pricing structure she found more reasonable. She signed on.

When she initiated her first ProNet search, Calabi received a stack of

résumés. But before she could study them, a headhunter she had used before handed her a résumé and said, "hire this guy." She did, and she paid the headhunter's fee. When she finally tackled the ProNet stack, she saw a résumé that looked very familiar: it described the new employee. She says that using ProNet in the first place would have saved her \$12,000. She went on to make a hire entirely through ProNet and was impressed by several of the interviewees.

Paul Laferriere, '86, came to ProNet from the applicant side. He was using all the conventional methods to look for a new job in California and not having much luck. After joining ProNet, he was asked to interview for an attractive position back in Cambridge as a research engineer. He got the job and has now been on the East Coast for a little under a year. With ProNet, he says, "the leads are very high quality because you've already matched [the companies'] criteria." He feels ProNet is underused by alumni/ae, though. "More people in the database would encourage more companies" to join, he says.

ProNet does not require either companies or alumni/ae to report on the outcome of a contact. It's a streamlined procedure that guarantees confidentiality for all parties, Jordan says, but it also means that ProNet does not have statis-

tics about the number of successful matches to help in marketing its services to potential employers. The service uses the number of alumni/ae with whom companies request interviews—more than 1,000 in 1992—as a measure of its success.

A lifetime membership in ProNet costs alumni/ae of member universities only \$25. New subscribers are sent a registration disk, which gives them more space to fill out their career history than a traditional résumé. This profile is then stored in the secure ProNet database and updated yearly.

For an additional \$25, applicants can be placed on "active" status and will receive six months of the "ProNet Job Bulletin," which lists available positions. Active participants may also fill out a Position Request form detailing the job they're looking for, which ProNet circulates to subscribing companies. In both cases, ProNet preserves the confidentiality of applicants and companies.

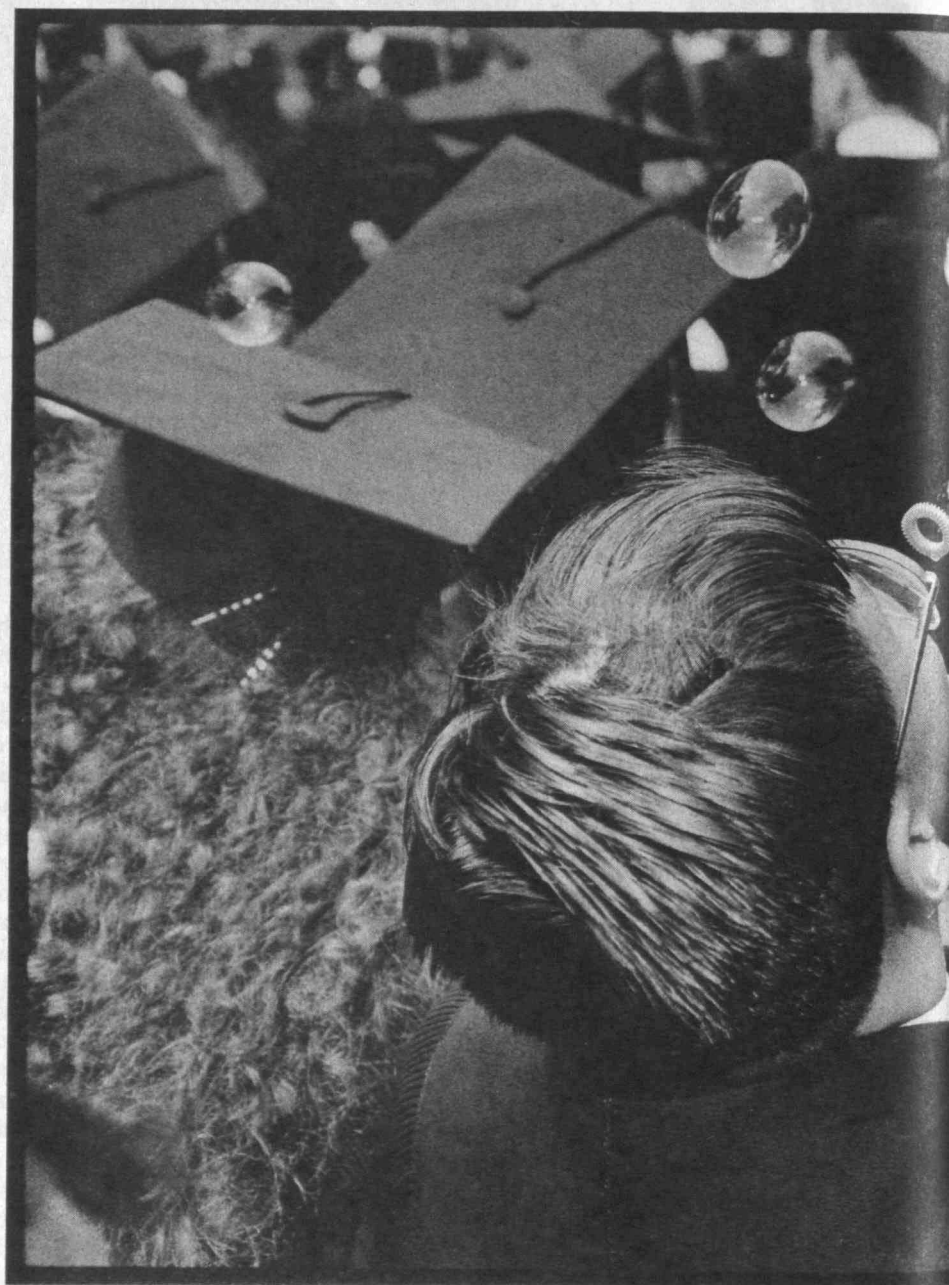
Alumni/ae wishing to become ProNet members may call 617/248-5899. Companies that want to sign on should call 800/726-0280. □—Amy Souza

The author is an administrative assistant in the Reunions and Special Events Group of the Association of MIT Alumni and Alumnae.

COMMENC

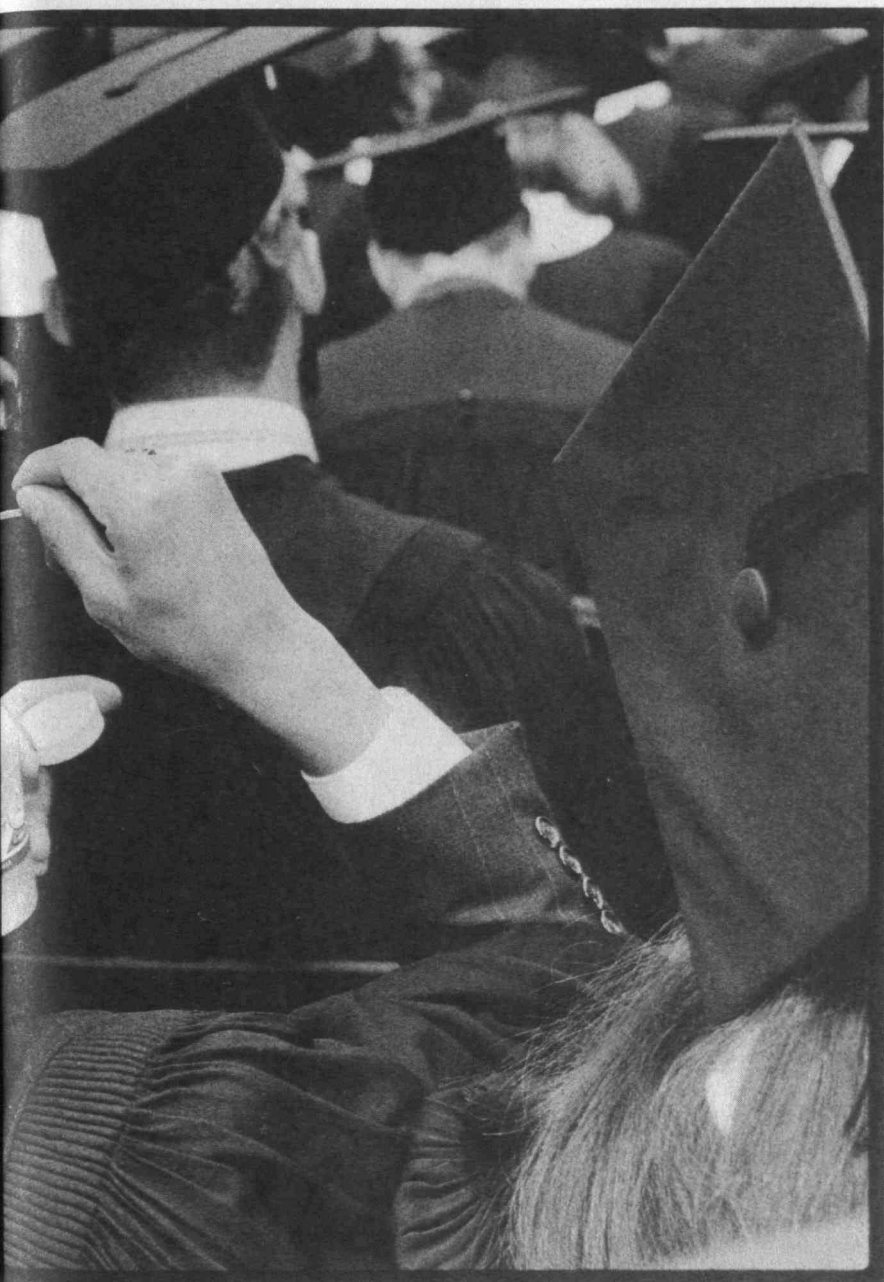


SOME STANDARD INGREDIENTS IN THE RECIPE FOR AN MIT COMMENCEMENT: THE GREAT DOME OVERLOOKING A CANVAS-SHADED PLATFORM, ROWS OF GRADUATES FILLING KILLIAN COURT, CONFERRING OF PHD HOODS—HERE WITH DEAN ISAAC COLBERT PRESIDING, AND THE PRESIDENT OF THE ALUMNI/AE ASSOCIATION—THIS YEAR ROBERT MUH, '59—CARRYING THE MACE AT THE HEAD OF THE PROCESSION. LEAVENING OF CHOICE: LIQUID BUBBLES.



PHOTOGRAPHS BY PAULA LERNER

EMENT, '93



At the Institute's first barrier-free graduation exercises, amid head-of-state-caliber security, 1,750 of the "best-prepared professionals in the world" received degrees.

BY DEBRA CASH

May 28 wasn't only MIT's 127th Commencement. It was Reshma P. Patel's birthday.

In one of the moments that marked a solemn ceremony with some much-appreciated informality, MIT President Charles Vest added a chorus of "Happy Birthday" to Commencement exercises as he accepted the class gift from the class of 1993, which Patel had been elected to head.

No one could have predicted what it would sound like when more than 8,000 guests and 1,750 seniors and graduate students raised their voices in song, but this impromptu chorus underlined the combination of rigorous planning and improvisation that marked the occasion. With chilly weather and drizzles throughout the morning, graduates and their families and friends attending one of the largest graduation exercises in the Institute's history were rewarded for their resilience by sun that ultimately broke through the clouds over Killian Court.

The preparations for this year's Commencement had included a thorough back-up plan and a new

emphasis on offering a barrier-free environment for all disabled students and guests. For the first time, families and students were alerted that they could order audio enhancers and Braille programs and make special arrangements for wheelchair parking. "When they built these buildings, they didn't have the needs of disabled people in mind," commented Mary Morrissey, director of special events and executive officer for Commencement.

Security was tight surrounding the presence of Mexican President Carlos Salinas de Gortari.



PRESIDENT SALINAS

Secret Service from Mexico and the U.S. State Department—instantly identifiable by their dark clothes and the telephones that seemed permanently affixed to their ears—joined forces with MIT security staff to make sure that every step of the president's visit could be protected.

Rabbi Daniel Shevitz gave his final invocation at MIT, having already packed his books and ensconced Peretz, his pet parrot, in his family's new home in Oklahoma City. [*The text of his invocation appears in this section.*]

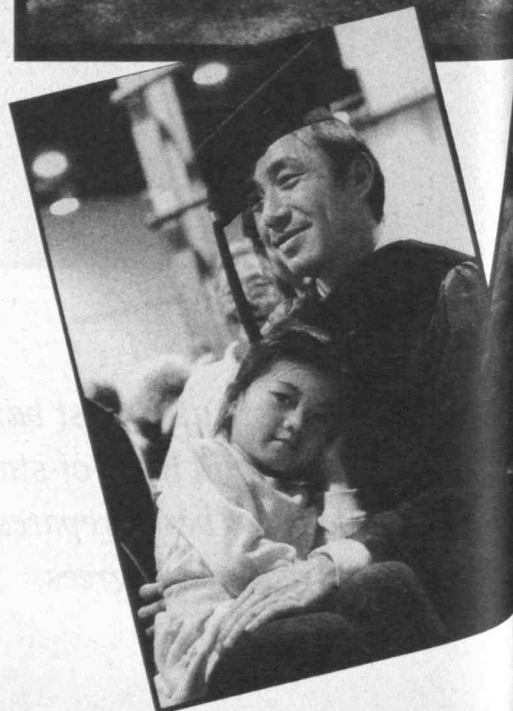
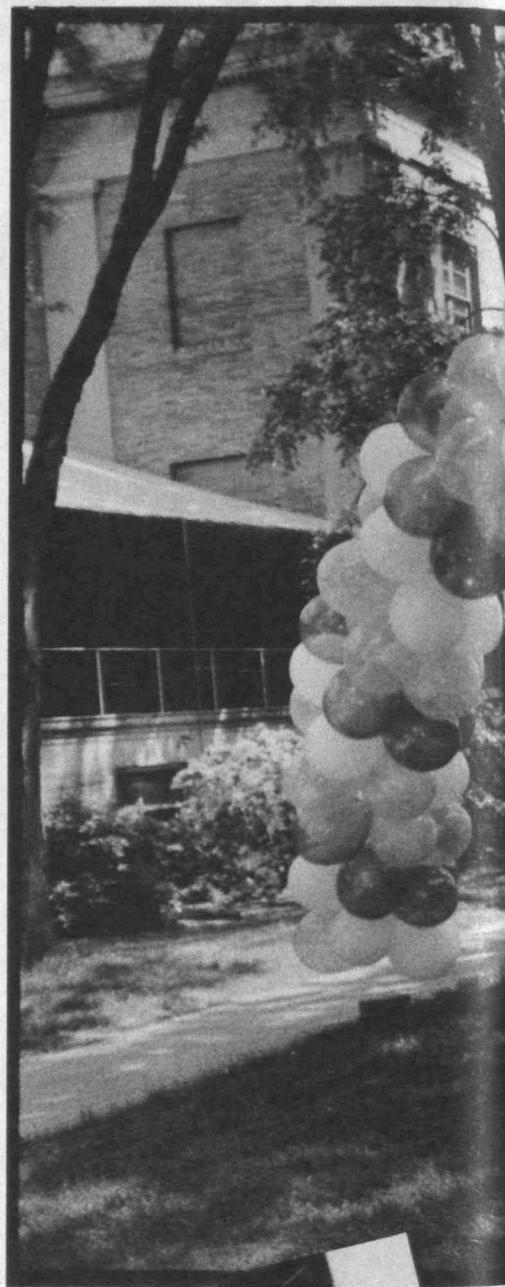
President Salinas in his com-

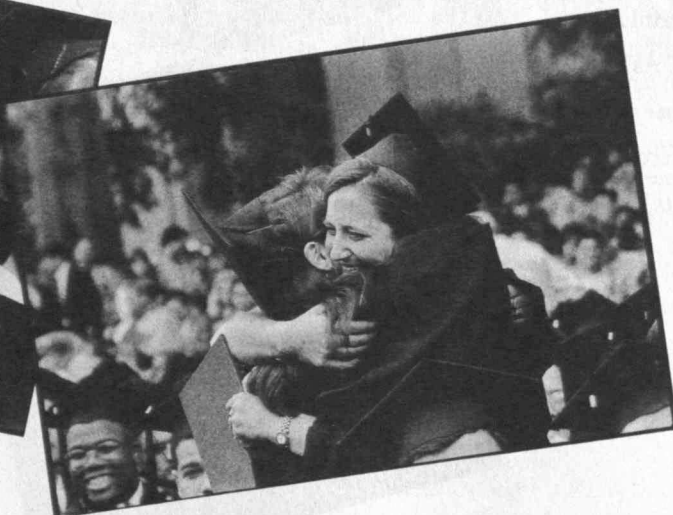
mencement speech exhorted the graduates to "be part of the creation of a new era."

"While you were studying, the map of the world was being redrawn," he commented, going on to an impassioned defense of the proposed North American Free Trade Agreement. NAFTA, Salinas argued, "is a job-creating agreement . . . an environmental-improvement agreement . . . a wage-increasing agreement . . . [and] a migration-reduction agreement."

"What does it mean to an MIT student who is graduating today?" he asked. "In carrying out your studies, this tremendous change in the world, in Mexico, and in Mexican-American relations, may sound far away. But the world that you will now encounter will not let you forget its relevance in your daily life. You will compete for a job dependent upon what happens in Europe, in the Asian-Pacific countries, and also in Mexico."

And in congratulating the graduates, whom he called "among the best-prepared professionals in the world," President Salinas added "I challenge you respectfully to tackle the future with the same interna-

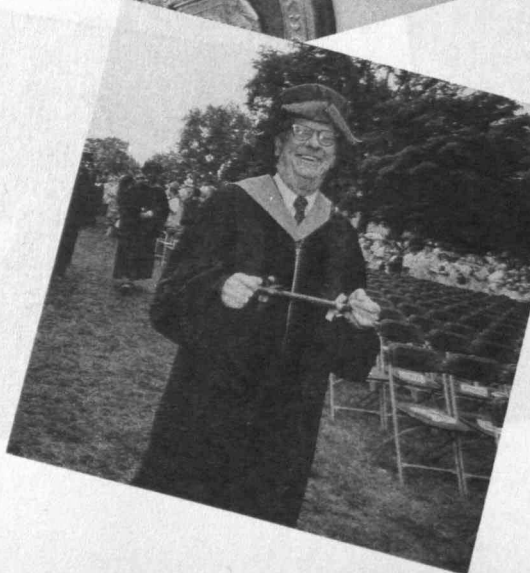
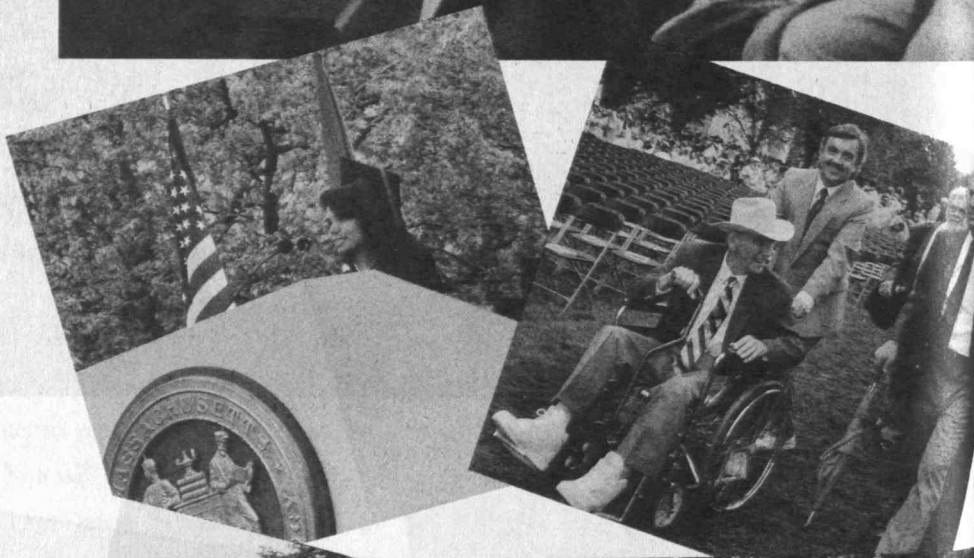
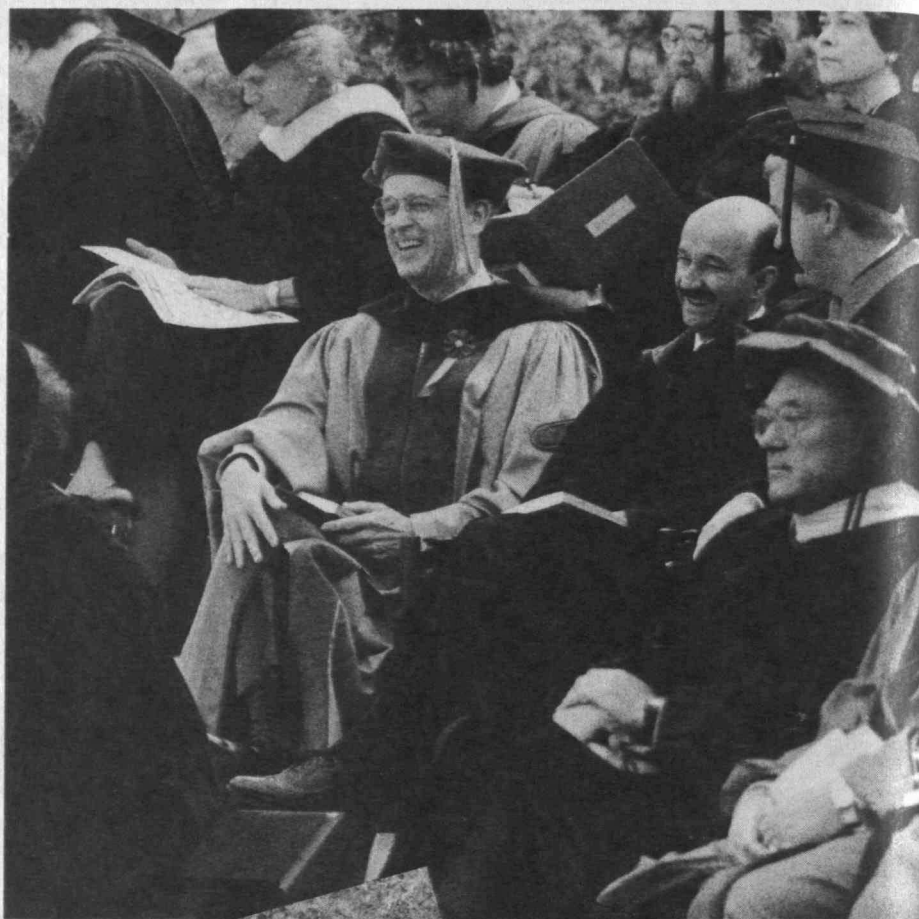




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OCCASION
WHERE PRIDE
IS IN ORDER:
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ONE'S FAMILY
MEMBERS,
IN ONE'S
PEERS, IN
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tional character that MIT has always shown."

President Vest, following President Salinas's remarks, agreed that graduates were entering a world in which "new balances must be struck. We must resolve the tensions between competition and cooperation, between fragmentation and integration, between nation and world." Citing the ability of semiconductor manufacturers to work in consortium with universities, and arguing against isolationism and protectionism, Vest said "the electrical engineer and the mechanical engineer are able to build systems together that neither can build alone. Men and women come together to create a balanced discourse and world view. Black and white, brown and yellow, red and tan, create a campus and a nation far more meaningful and creative than any alone. As you shape the future you must respect and cherish differences, but you must build common purpose and values." □



To See the Fire and Hear the Message

An Invocation by Rabbi Daniel Shevitz

CLOCKWISE STARTING ABOVE. MIT PRESIDENT VEST (CENTER, IN GLASSES) SHARES A JOKE WITH MEXICAN PRESIDENT SALINAS ON HIS LEFT AND MASSACHUSETTS GOVERNOR WELD ON SALINAS'S LEFT. ILLNESS COULD NOT KEEP ALFRED EMOND (IN COWBOY HAT) FROM JOINING GEORGE FREEDMAN (UMBRELLA) AND OTHER MEMBERS OF THE CLASS OF '43 IN THE PROCESSION. (PUSHING EMOND'S WHEEL-CHAIR IS HIS SON BRUCE, WHO WITH HIS BROTHER KIM SPENT REUNION WEEK WITH THEIR FATHER AT MIT.) CARRYING THE BANNER FOR THE 50-YEAR REUNION CLASS ARE RALPH LEADER (LEFT), THE REUNION CHAIR, AND STANLEY PROCTOR, REUNION GIFT CHAIR; CLASS PRESIDENT JAMES MCDONOUGH IS DIRECTLY BEHIND LEADER. THE DEAN OF UNDERGRADUATE STUDENT AFFAIRS, ARTHUR SMITH, HAD THE HAPPY TASK OF LEADING UNDERGRADUATES INTO KILLIAN COURT. PRESIDENT OF THE CLASS OF '93 (AND BIRTHDAY CELEBRANT) RESHMA PATEL PRESENTED THE CLASS GIFT: PLEDGES TOTALLING \$30,071 OVER FIVE YEARS TO STRENGTHEN MIT'S RECYCLING EFFORTS.

I have good news and bad news. The bad news is that they didn't teach you enough. Oh, they taught you how to do, how to make, how to design and construct. Perhaps they even taught you how to think and how to feel. But that's not going to do it for you. You have pulled endless all-nighters, done hundreds of problem sets, consumed thousands of pizzas, and it's still not enough.

Did they promise you that they'd teach you what was important? It was half true. What they taught you was important, but what they couldn't teach you was even more important. And your teachers knew it all along.

You are undoubtedly well equipped for your careers, but life is more than that, and our careers will not save us. Redemption will depend less on how many hours you put into your thesis, and more on how you treat those around you when you're under pressure. Your happiness will come not from the recommendations the faculty writes for you, but from how your friends and family love you, criticize you, and forgive you. Your success will be measured not by your publications, but by how you treat the typist. These are matters that are generally not part of the curriculum.

Oh poor, poor MIT; so far from Heaven, so close to Harvard! There just wasn't enough time for everything. So the faculty made a deal with you: they said, we will teach you what to do; you must figure out who to be. And that is ever so much harder than 6.001.

But the good news is: you're out of here! And now you will begin to see the tremendous value of the education you have received and the stupendous responsibility of using it well. Only when you know the limits of your knowledge, and of knowledge in general, will you begin to savor the delights of wisdom, and, I dare to add, the possibility of holiness.

My tradition teaches that when he was just beginning his career, Moses had a vision of a burning bush. The bush burned with fire but was not consumed, says Scripture. Moses is quoted, "Let me turn aside and see this wondrous thing!" I like to think that the bush had been there, burning for years, and everyone else, much too busy doing Very Important Things, glanced at it and hurried off to a meeting or a presentation or to write a grant proposal. Only to Moses did it occur that he was not so busy that he couldn't stop to check out something that had no immediate use to his career advancement.

There are bushes burning everywhere. All around us. And the voice of God yearns to be heard, calling us to bring heaven and earth a bit closer. You will see these fires if you are fortunate, and you will hear the voice if you merit it.

Some of the fires will be destructive, and threaten a conflagration, and these you must attack with all the cleverness and tricks you've learned in these halls of knowledge; but others burn and do not consume. These are the ones which a busy man or woman will pass by; but the curious of spirit will turn aside to wonder at that which cannot be grasped with mind alone. And in the true humility in your frailty, and in the true pride in your ability, you may hear the voice of God speaking to

each one of you out of those flames. That Voice will deliver but one message, as it always has, for prophets, saints, and all those who may listen; that Voice will say: "Go ahead, . . . Make. . . My. . . Day."

May you go from strength to ever greater strength, and may the vision of a redeemed world always be before you. □



THE RABBI IS PICTURED WITH HIS WIFE, AMY HILL SHEVITZ, AND HIS SON, NOAH.

This was Rabbi Shevitz's last invocation at MIT Commencement: after 17 years, he is leaving MIT Hillel to head a synagogue in Oklahoma City.

PHOTO: DONNA COVENEY

Riot-Ready in Rockwell Cage

Remembering Commencement '71

BY ERNEST RABINOWICZ

In 1971, the approach of summer with its exodus of students promised a hiatus in the months of tense confrontations between faculty, staff, and local authorities on one side, and on the other, students disaffected by the war in Vietnam, a callous administration in Washington, and a litany of additional issues.

But first we had to get through Commencement. Many colleges decided that the threat of an unmanageable situation was too great, and they cancelled graduation exercises altogether. But MIT's Commencement Committee, after long discussions, decided to proceed. Committee members also agreed to take every precaution to head off dissidents who might wish to interfere with the ceremony, and to that end they consulted with experts on riots and generally disruptive behavior.

In any confrontation, the committee was advised, a very small proportion of determined people can be extremely effective: they are often well led, united, and have a specific objective—any disturbance at all will achieve their ends. The large group of people who want the scheduled activities to continue are usually passive, and their leaders are geared to running an event, not managing a conflict. The solution, said the experts, was to prepare people from “our side” to manage conflict—to put someone in charge who would be ready to take whatever steps were necessary.

The president, Howard Johnson, and the chairman of the Corporation, the late James R. Killian, Jr., '26, would be busy enough trying to conduct a straightforward graduation, so Committee Chair Nathan Cook, '50, my friend and colleague, asked me if I would be the “person in charge” if there was trouble.

I was reluctant. I don't consider myself someone who thinks quickly on his feet, nor can I claim the charisma of leadership. So I suggested other names, people I thought more qualified. No, no, said Cook, the people I thought of as charismatic were also undependable. This situation called for rock-solid common sense, and he insisted that I was perfect. I couldn't refuse.

Nate's crisis-management plan was a model of redundancy. If any single compo-



nent failed, another would be ready to take its place. Two people were ready to take charge: myself and Eugene Chamberlain, one of the associate directors of admissions. If one of us was put out of action—a sobering thought, but appropriate in 1971—the other would take over. A bullhorn was stored under each of our chairs, one using the building's electric power supply, the other battery powered.

The committee was particularly concerned that dissident MIT students—with their acknowledged potential for electrical wizardry—would commandeer the public address system. So the Institute put its best people on the task of rendering its system impervious to tampering or take-over. Last but not least, Prof. Warren Rohsenow was assigned to carry extra academic gowns, ready at a moment's notice to throw them over any student who approached the platform nude!

In the weeks leading up to Commencement, I practiced soothing speeches. “Now, folks, let us have no panic. The smoke bombs have incapacitated only 30 or 40 people. While the Medical Department personnel are looking after them, everyone please file smoothly out of the building, turn left, and proceed to du Pont Court, where a sumptuous luncheon awaits us.” But I never sounded either convincing or

consoling, even to myself.

On the morning of Commencement, the academic procession made its way into Rockwell Cage, where the ceremony was to be held. Gene and I peeled off from the lines to sit on chairs covered in white sheeting to conceal the bullhorns. I was assigned to sit next to the 50th Reunion class in their red jackets, while Gene sat next to the Corporation members on the other side of the platform.

I took my seat next to the marshal of the Class of '21, Irving Jakobson, and introduced myself, telling him that I was in charge of countermeasures. I was about to tell him of my responsibilities when he interrupted me. “Good man, I am so glad to see you,” he said. “I know they are planning something, but I don't know what it is.”

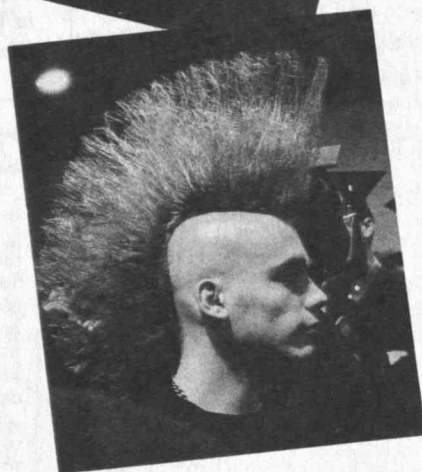
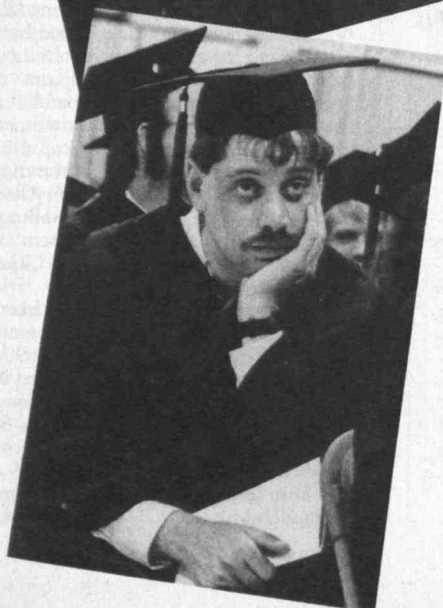
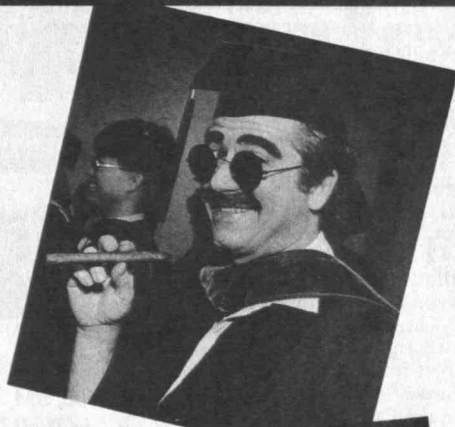
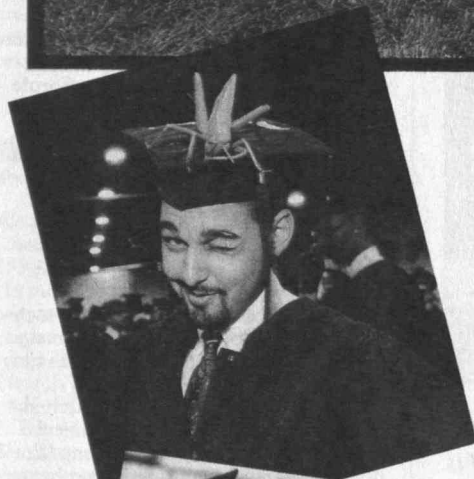
Eager to further reassure him that the situation was well in hand, I finished up with, “I have the tools of my trade with me,” and pointed knowingly in the direction of the bullhorn hidden under my seat. He quickly turned to a classmate on his left. “See that chap next to me, he is in charge of countermeasures, and he has a submachine gun under his seat.” The image of myself—a person who had been apprehensive about using a bullhorn—as the armed MIT equivalent of 007 was unexpected and sensational. I sat stunned and silent as explanations of my presence and power spread through the ranks of the veterans.

I don't have much recollection of Commencement itself. I do remember that the students wore an exceptionally wide range of attire, from academic garb to regular clothing to hardly anything at all. A few painted their bodies, I think, rather like Britannicus in George Bernard Shaw's play “Caesar and Cleopatra.” President Howard Johnson seemed not to notice, greeting each student with a smile and words of congratulation. The ceremony went off without a hitch, and any talent Gene and I may have had for coping with riot and insurrection went untested. □

—The author is a professor of mechanical engineering. Unfortunately, the MIT Museum could not provide the Review with a photo of graduates in body paint.



EVERYONE HUNG ON, WRAPPED IN MIT'S DISPOSABLE, CARDINAL AND GRAY RAINWEAR, THROUGH THE DISMAL, DRIPPY WEATHER THAT MARKED THE OPENING OF THE EXERCISES, AND THEY WERE REWARDED WITH A RECEPTION IN BRIGHT SUN. EVEN WITHOUT THE RAIN, SITTING THROUGH THE DISPENSING OF HUNDREDS OF DEGREES WAS AN ENDURANCE TEST, AS THE GRADUATE AT LOWER LEFT CAN ATTEST. THE TEDIUM WAS LIGHTENED BY DECORATED MORTARBOARDS, GROUCHO MARX ACCESSORIES, OR A GLANCE AT WALTER MULLER, '93, WHO WAS HAVING A PARTICULARLY GOOD HAIR DAY.





CLASS NOTES

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We regret to report the passing of another of our wonderful classmates. Jane Richardson called in early April to tell us of the death of her father, **Chester N. Richardson**, on March 29, 1993. We had the great pleasure of meeting Chet and Jane at our 65th Reunion. They were delightful and mixed beautifully with all of us who shared that extraordinary weekend. Again, at the 70th, Chet and Jane attended along with his other daughter, Ruth. Unfortunately, we didn't schedule a 75th; surely, Chet would have been there.

We quote in part from the local newspaper's wonderful summary of Chet's life of 98 years: "Retired electro-chemical engineer... a veteran of World War I. In 1924, he was employed in the Research Department of Mathieson Alkali Works and had several patents in the electro-chemical field, specifically the manufacture of chlorine. He was employed in the U.S. Department of Agriculture, where he assisted in developing the process of manufacturing ammonium nitrate fertilizer, which revolutionized the farming industry. During the 1950s, he worked with Admiral Hyman Rickover in developing the process of nuclear power for Navy vessels, including submarines and aircraft carriers. He taught metallurgy for one year at the University of Buffalo. During the late 1960s, he retired to full-time farming and worked with Cornell University and the Geneva Experimental Station in the development of the Hedelfinger cherry tree. While living in Washington, D.C., he was a member of St. Albans Church, part of the Washington Cathedral, and was the lead basso singer. He was also a member of the Buffalo Guido Chorus of Niagara Falls." Jane indicates that Chet was an active member of St. John's Episcopal Church in Youngstown, N.Y., and was singing regularly in their choir until shortly before his death. Chet had a very interesting life, filled with many important accomplishments and a wonderful family. "Well done, good and faithful servant."—**Bob O'Brien**, acting secretary, 25 Keith Rd., Pocasset, MA 02559

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75th Reunion

Today I telephoned **George Michelson** and he answered at once. We had a good talk and I found him in good fettle and glad for the call. I told him of my recent call to **Don Way** when his wife, Barbara, informed me that he was just home from a two-week period in the hospital for treatment of a heart attack. Don didn't feel like talking at that moment so I asked George to write him a letter to cheer him up. Both of these men were good friends

when we were at the Institute and on many subsequent occasions. Barbara is sending me a copy of a letter Don received from one of our classmates.

A few weeks ago I crossed over to my 99th year on planet Earth. I am glad to be around and will try to see that Class of 1919 is not forgotten. Best of everything to you all.—**Bill Langille**, secretary, Box 144, Gladstone, NJ 07934

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Please send news for this column to: **Harold Bugbee**, secretary, 313 Country Club Heights, Woburn, MA 01801



Do you know this boat? Scott Berkenblit, '86, SM '90, PhD '94 (hopefully), spotted it in Wellfleet Harbor, Cape Cod, and figured it MUST belong to an MIT grad...

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It is with extreme regret that we report the resignation of **Sumner Hayward**, our superb secretary and treasurer, who cites health reasons. Sumner has faithfully maintained a top-notch record in these columns for many years. Also he has been a thorough financial officer and has turned our treasury over to MIT for safekeeping and ready access so long as our class exists.

We have extended thanks and appreciation to Sumner for his long term of superior service to all of us and urge you to add a personal appreciation. Address him at Wellspring

House, E64, Washington Ave. Ext., Albany, NY 12203, where he is near his daughter Priscilla and the nursing home where Betty lives.

We are proud to introduce **Cindy Kim**, '93, of Blue Bell, Pa., a senior biology major who has been honored by MIT with the award of the Class of 1921 Scholarship, supported by the generous annual Alumni/ae Fund giving by our classmates and members of their families.

A native of South Korea, now a U.S. citizen, Cindy has an outstanding record in academic subjects as well as in work on several research projects in the field of the brain and related cognitive science. Besides her notable scholastic attainments, Cindy also has been active in student affairs and plays volleyball and other sports.

Congratulations, Cindy, and best wishes from all of us!

Following the custom of our earlier span of 51 years as 1921's secretary and treasurer, your budding Pooh-Bah (president and class agent) again begs you to direct to us a letter, postal card, or phone call (908/528-8881) with some news of yourself so we can continue Sumner's unbroken record.

Tell us whatever you wish to help ensure that the fame of MIT will forever be recognized as the center of aMITy.—**Carole A. (Cac) Clarke**, secretary, 608 Union Lane, Brielle, NJ 08730; **Samuel E. Lundden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

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Where we are now in our 90s, your secretary has the task of informing classmates of life's ending for a number of us as time goes on.

Walter M. Saunders died in March in Yarmouth, Maine. He was a chemical engineer and a metallurgist. During World War I, his laboratory was certified by the government for testing war materials. At that time, he was appointed adjunct instructor at Brown University and at a Pratt and Whitney program for women. He lived in Providence, R.I., most of his life. For 30 years, he operated at a commercial analytical and metallurgical laboratory in Providence and was a consulting metallurgist for several foundries and manufacturers of metal products. In 1970 he retired to Cape Elizabeth, Maine.

Lester N. Odams, Sr., also died in March, in Beaufort, S.C. He was 97. After attending the University of Massachusetts, Mr. Odams did graduate studies at MIT. He served in World War I in France. Later on he was an employee of the Blackstone Valley Gas & Electric Co of Pawtucket for many years before retiring in 1960 as treasurer. He leaves a son, four grandchildren, and three great-grandchildren.

Your secretary has just received a note from James F. Hoey, Jr., '43, to let us know that our classmate, **Harold Earl Burnham**, died on April 9, 1993, at his home in Sanibel, Fla. Harold was 92 and was in good health to the end.

Many of our class of '22 are still very much "alive and kicking." Do write to me of your activities.—**Martha Munzer**, secretary, 4411 Tradewinds Ave. E., Lauderdale-By-The-Sea, FL 33308

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It is April and a beautiful sunny day here in Vero Beach, Fla. The reunion, which has not yet come to pass, will be reported on next issue. **Harry Green** plans to attend. We now have a total of seven grads plus wives. Being reluctant to have Dr. Vest and his wife spend the most important day of the year with only seven grads, we invited the class of 1928 to join us.

The Reaper has taken more of our class. **Harold R. Bjerke** of Oslo, Norway, died on November 11, 1992. . . . **Charles E. Loud** passed away February 15, 1993. He was a retired assistant engineer for the New England Telephone Co., Boston, and lived in Hingham, Mass. . . . **Louis A. Metz** of Village of Golf, Fla., passed away December 30, 1992.

William P. Upham of St. Petersburg Beach, Fla., died February 21, 1993. Bill was the first mayor of St. Petersburg Beach and was a great influence in the growth of the community. Bill had made tentative plans to attend the reunion.

This column is not going to be of much interest to you unless you write to me and tell me what you are doing.—**Royal Sterling**, secretary, 2350 Indian Creek Blvd., Apt. D-201, Vero Beach, FL 32966, (407) 562-3937

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70th Reunion

We have been informed that a classmate, **Gordon C. Joyce**, passed away March 17, 1993, after a long illness in Deer Isle, Maine. He majored in naval architecture and marine engineering at MIT. He worked for the New England Telephone Co. for 43 years. He also was a lifelong member of the First Baptist Church of Malden and of the Mt. Vernon Lodge of Masons. He is survived by his wife, F. Ethel (Mabey) Joyce. In addition are his daughter, Carol Gotwals, and her husband, Vernon Stonington; one son, Arnold W. Joyce, and his wife, Diane, of Lexington, Va.; 10 grandchildren, and 12 great-grandchildren. He was predeceased by a daughter, Elsa (Joyce) Straton, in 1983. Condolences to all the family.

Mail sent by the Alumni/ae Association to **Elden D. Pollock** in Everett, Wash., was returned by his daughter, Mrs. Wendy Man, with the information that her father had died June 26, 1992. Our sympathy to her and her family.

Yours truly just returned from the Kentucky Derby. We had fun and didn't lose too much on the races. I was doing fine until the Derby race. Then I bet the farm on ol' Rock-amundo, and in a field of 18 he came in *third from last!* But the Mint Julips were out of this world.—Co-secretaries: **Katty Hereford**, Box 5297, Carmel, CA 93921; **Col. I. Henry Stern**, 2840 S. Ocean, #514, Palm Beach, FL 33480

Max Seltzer, 1898-1993

Faith of an Anonymous Benefactor Repaid in Spades

Max Seltzer, '18, arrived at "Boston Tech" on Boylston Street in 1914 as a precocious 15-year-old from Lexington, Mass., with a scholarship from an anonymous benefactor in his hometown. He chose to major in chemical engineering, and worked on the *Tech Monthly* and *The Tech*. And soon enough he started building the record of devoted service to the Institute that became legendary among wearers of brass rats around the world.

Seltzer died on May 15, 1993, after a brief illness, at the age of 95.

As he told it, Seltzer's first volunteer assignment for MIT was to help move the library from the Rogers Building in Boston to the new campus in Cambridge in 1916. Seventy-seven years later—and less than two months before his death—Seltzer was still participating in at least one alumni/ae activity planning meeting and writing his class notes.

After graduation, Seltzer continued for several years as an engineer in the MIT Laboratory of Applied Chemistry. By 1925 he had entered the field of industrial heating and supplies, in which he soon had his own sales and distribution firm. But his interest in MIT never faltered. He was active in his class, becoming class secretary in 1968. He made sure there was always news for the Class of 1918, often hand delivering his class notes just to pay a visit to MIT.

His participation in fund-raising included every major capital campaign conducted by MIT. In addition, he helped plan alumni/ae programs, seminars, and national conferences, and he became a pillar of the Boston Stein Club.

In 1972, the Alumni/ae Association Board of Directors recognized Seltzer's many contributions by giving him the Bronze Beaver, the association's highest award for outstanding service to the Institute.

That service continued, and ex-

panded. His interest in intellectual and political issues at the interface of technology and society led Seltzer to propose in the early 1970s what has now become—thanks in considerable measure to his efforts and enthusiasm—the Boston Seminar Series. The program's success has inspired a similar series in Washington, D.C.

At the end of the 1970s, Seltzer conceived and pursued a new mechanism for maintaining the interest and support of older graduates—those who have passed their 50th reunions, traditionally the apex of alumni/ae activity. Seltzer's instinct about how to involve his fellow graduates was right on target: the Cardinal and Gray Society, which held its first meeting with Seltzer as founding president in 1981, is now "one of our most energetic organizations for alumni and alumnae," says William J. Hecht, '61, executive vice-president of the Association.—**John Mattill** □



Max Seltzer, from the 1919 Technique

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QUALITY IN ACOUSTICS REQUIRES SOUND MANAGEMENT.

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Alan Crowell writes that when he turned 90 on January 5, 1993, he realized it was time to consider distribution of assets to minimize estate taxes. He is working with Hugh Darden on a death benefit donation for undergraduate financial aid. In the meantime, Alan says he will continue Great Dome Donations.

The passing of two classmates must be reported. Karl Van Tassel died on April 11, 1993, at the Lake Forest Hospital in Lake Forest, Ill. After graduation, Karl joined the General Electric Co. as a student engineer. He worked in many capacities and in several G.E. plants, becoming general manager of the Knolls Atomic Power Laboratory (KAPL) in 1953. During his tenure at KAPL, Karl headed its atomic products study in 1955, which determined the feasibility for commercial atomic products. He also was responsible for the development and testing of atomic power plants for the submarine *Seawolf*. Under his management, the laboratory's safety record earned the Atomic Energy Commission's top award.

After 31 years with GE, Karl was named executive VP of A.B. Dick Co. in Chicago in 1956. He served as president and CEO of the company, retiring as president in 1971. Karl was a member of the board of visitors and governors of St. John's College, Northwestern University School of Business Advisory Council, advisory committee of the University of Illinois College of Business, former president of the MIT Club of Chicago, former chair of the MIT Alumni/ae fund, a founding member of the Sustaining Fellows of MIT, former member of the MIT Corporation Development Committee and the MIT Library Visiting Committee, a recipient of MIT's Bronze Beaver Award, the MIT Corporate Leadership Award, and MIT Development Committee's Dalton Award. He also established a career development chair in electrical engineering and health technology at MIT. Karl and his wife established several scholarships at MIT. Karl is survived by his wife, Evelyn, two daughters, eight grandchildren, and three great-grandchildren.

George Monroe Patch died in Richardson, Tex., on January 1, 1993. He attended Stetson University in Florida and entered the Institute as a senior taking chemical engineering. George worked in the petroleum industry, being employed over the years by what is now Exxon.—F. Leroy "Doc" Foster, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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Please send news for this column to: Donald S. Cunningham, secretary, Eventide, 215 Adams St., Quincy, MA 02169, (617) 328-1840

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Theodore E. Casselman of New London, N.H., died on February 20, 1993. He attended Stevens Institute of Technology before entering MIT and received an SB in mechanical engineering with our class.

He began a career with Stone & Webster Engineering Corp. in Boston and became treasurer for several years. He was appointed the managing director of the London Office of

Stone & Webster Ltd. He retired from the firm in 1970 and moved to Wolfeboro, N.H.

In 1980 he moved to New London where he and his wife of 52 years, Dora, have lived. In New London, he was a member of the First Baptist Church. We offer our condolences to his widow and their family.

After visiting with my family in Epping, N.H., and enjoying a wedding of a member of the family, Phyllis and I will be enjoying our summer cottage on an island near Boothbay Harbor, Maine, this summer. Note change of address. Come see us and join us for a sail.—Joseph C. Burley, secretary, Isle of Springs, Maine 04549; Lawrence B. Grew, assistant secretary, 21 Yowaga Ave., Branford, CT 06405

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Though our 65th Reunion has become history at the publication of these notes, it is still a coming event from the current viewpoint of this writer and it will be left to the passage of time to make relevant comments. Surely, with our past reunion experience it could only have been a most meaningful affair, though with sadly reduced attendance. Come another month we can all get in tune talking about the past and thinking of the future.

With the approach of another winter a pertinent item has been received regarding the influence of Roger Haven, an avid iceboat enthusiast, in the construction (by other people) of two iceboats of Roger's design, which incorporates novel performance features.

There are the inevitable deaths of classmates to report. I received delayed notification of the death of George Vincent Larkin, who died on January 13, 1991. Huguenin Thomas, Jr., died on March 4, 1993; and Willis Ford Tibbetts died on March 8, 1993. Willis has attended many of our reunions and was missed at our 60th.—Ernest H. Knight, secretary, Box 98, Raymond, ME 04071

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65th Reunion

A Christmas letter 1992, from Harold Weddle and wife, Esther, of San Diego, Calif., reads: "The high point of the year was the celebration of our 60th wedding anniversary in June. Our sons, Stephen of Chappaqua, N.Y., and Richard of Helena, Mont., both thought of the idea. Four of us met at the Kansas City airport, rented a car and drove 200 miles west to Lindsberg, Kans. We had dinner at Hotel Brunswick, which my parents operated for 50 years. Next day we drove to 'the farm,' visited with the tenant whose father, and now the son, has been farming this land for over 40 years. This land was homesteaded by Esther's grandfather in 1864. Steve and Rich had the experience of riding in the cab of the combine for threshing wheat. Can you imagine the cab was air conditioned! Later we visited the house in Lindsberg where Esther was born. We also visited the high school that Esther attended and later taught home economics for two years after graduating from Kansas State. On the third day, we drove back East with a stop in Manhattan, Kans., Esther's hometown, and Kansas State University where Esther and I attended college and first met. The last leg of our trip was to Lawrence, Kans., to attend the wedding of Esther's great-niece. From there back to the Kansas City airport and home."

J. Wesley Walters (wife, Josephine) of St.

Paul, Minn., writes: "Last March, we had an accident with our car while parked at Ward's Store. Josephine had six broken ribs on her right side. She was hospitalized for two days and spent two weeks in a convalescent home. In all my driving days since I was 13 years old, this was my first accident, and first scratch on my car." . . . I have a note from Louis F. Southerland, Jr. (wife, Jean) of Austin, Tex.: "As to the 65th Class Reunion next year, 'the Lord willin' and the creek don't rise' I'll be there. Look forward to seeing you then." . . . A note from Sam Shaffer of Los Angeles, Calif.: "Looking forward to seeing you all next year in Cambridge, Mass., for our 65th Class Reunion. Thank God my health is good. I am alone, as you know, as I lost my wife. I do okay. I have now two great-grandchildren. Regards to all." Sam has attended several class reunions with his wife, who passed away about six years ago. He attended our 60th in Cambridge alone. He lists golf, gardening, and financial consulting among his hobbies.

I have wishes for a speedy recovery of my eye from several classmates: Earl Erickson and wife, Marion, of Burlingame, Calif.; Robert Pride and wife, Marion, of North Palm Beach, Fla.; and Richard Piez of San Mateo, Calif. . . . Butler King Couper of Tryon, N.C., writes, "Thank you very much for helping E. Neal Wells to get in touch with me. He is one of very few SAE fraternity brothers still around." . . . Virgil W. McDaniel (wife, Betty) of Essex, Conn., write: "Continuing to enjoy life in a new mode of living in this 'Life Care Community' with delightful fellow residents and a pampering staff."

I regret to announce the death of the following members of our class: George T. Logan, of Philadelphia, Pa., on August 30, 1991; Ernest Gunner Peterson, of Warwick, R.I., on November 8, 1992; James L. Cutler, of Cuyahoga Falls, Ohio, on August 1, 1992; Hyman J. Fine, of Norfolk, Va., on May 28, 1992; William H. Lerner, of Elyria, Ohio, on January 17, 1993; and Lawrence L. Waite, of Los Angeles, Calif., on December 26, 1992.—Karnig S. Dinjian, secretary, P.O. Box 83, Arlington, MA 02174

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Continuing last month's report on graduate students who received MIT degrees in 1930, Captain Thomas A. Turner is one of five U.S. Naval Academy graduates who received such a degree, in his case an SM in aeronautical engineering. He was for many years executive director of the Municipal Airport Authority in Jackson, Miss. His wife, Charlotte, reports that, like an increasing number of our classmates, he is in a nursing home suffering from Alzheimer's disease. . . . Captain Maxim W. Firth reversed Thomas' educational pattern: he attended MIT for a time and then transferred to the Naval Academy, from which he graduated. Thereafter he was a line officer in the Navy until his retirement. He and his wife, Junetta, live in San Rafael, Calif. . . . Thomas K. McManus spent a year at Georgia Tech and four years at the U.S. Military Academy before coming to MIT, where he earned an SM in mechanical engineering. After "limited military service" he spent most of his career in the construction industry, largely with Underground Construction Co. of San Leandro, Calif., a company he founded and of which he was vice-president. He has now retired and lives with his wife, Margaret, in Walnut Creek, Calif.

Earl Sloan's undergraduate degree was from Kansas State, and he then obtained an SM in civil engineering at MIT. After brief stints with the Texas and Oklahoma highway departments, he worked from 1939 until his retirement in 1974 for Phillips Petroleum Co., where he participated in a number of interesting projects, including the design and building of Phillips refineries and plastic plants both in this country and overseas in Belgium and India. Perhaps his most impressive job was on the Alyeska pipeline. You will recall that Alyeska was a multi-billion-dollar pipeline built by a consortium of eight oil companies to bring North Slope oil down to the ice-free port of Valdez. Because of the climate and fragile nature of the terrain over which it passed, the pipeline presented a considerable engineering challenge. The design work for the project was largely done in Houston, where Earl worked from 1970-74 with Ulrich Luscher, SM '59, ScD '63, a former MIT professor and soil mechanics expert. After Earl's retirement, as an incident of his second marriage, he became part of an impressively large family. It appears that he and his first wife had no children, but when he married his present wife, Dorothy, in 1988 he instantly acquired 3 daughters, 8 grandchildren, and 13 great-grandchildren, as well as assorted in-laws. He says that some of the younger members of his extended family are helping him with his golf game.

Clifford Himoe graduated from UCLA before he came to MIT, where he enrolled in the Electrical Engineering Department. He appears to have worked mostly as a civilian employee of the Navy, in particular as an electronics engineer and assistant industrial manager of a Seattle installation and later as a supervisor of Naval Electronics Systems in Crossroads, Va. He retired in 1975. He and his wife, Gladys, now live in Arlington, Va. . . . J. William Patton attended Drexel University in Philadelphia for three years before coming to MIT, where he enrolled in the Architecture Department. He spent much of his career designing steel railway cars, first with American Car & Foundry and later with the Budd Co. At the time of his retirement he was vice-president of A. Pomerantz & Co. in Philadelphia. He and his wife Kathryn now live in Jenkintown, Pa. . . . Supplementing Dave Houston's glowing description (in the May/June issue) of the new home he and Anne were building on Hilton Head Island, it appears that they have now moved in and that their enthusiasm for the new home and its environs remains unabated. Their new address is 20 Outerbridge Circle, Hilton Head Island, SC 29926. . . . We also received a card from Maryann and Maurice (Yicka) Herbert, mailed from San Jose, Costa Rica, after their passage through the Panama Canal, which they found quite impressive.—Gordon K. Lister, secretary, 294-B Heritage Village, Southbury, CT 06488

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Had a nice note from Howard B. Huntress in April in which he says: "After living in Suffern, N.Y., for 45 years, during which I spent 30 years as a development engineer with Abex Corp., Eleanor and I moved to Carolina Meadows, a retirement community in Chapel Hill, N.C. We live close to our daughter and her husband. Three sons, with their families, live in the Northeast. The big fun thing in our lives was owning a motor cruiser on the Hudson River for nine years. We joined the Tap-

pan Zee Power Squadron and had good times and lasting friendships. Now we do our chores, read and write, and make friends here.

Julien Ford Phillips of Glendale, Calif., was listed in the 1929 *Technique* as a "Wandering Greek" from California Institute of Technology. He enrolled in Course XV-1 with the Class of 1930 but graduated with our class. His son, David, of Sacramento, Calif., writes that his dad had come down with cancer last December after "86 full and rich years." Julien was hospitalized on Christmas Eve 1992. David and his wife, Valerie, visited him on the evening of December 31 and found him resting very comfortably. The hospital called at 2:40 in the morning of New Year's Day to say that his dad had passed away peacefully.

David writes, "We are glad for my father's full and incredibly impressive life, and are saddened beyond words by his passing. All who knew him will agree that he was one of a kind. We all—Dad's widow, Alice, his daughters Judy and Maryly, I, and our families—miss him intensely. At Dad's request, no funeral was held."

William Metcalf, a nationally known hand surgeon, died of pneumonia on March 11, 1993, at the Humana Hospital in North Miami Beach, Fla., at 84. He was born in Norwood, Mass., prepared for MIT at Boston English High School, and took chemistry at MIT. I understand he also attended a local Hebrew College.

After MIT he taught briefly, and then went to medical school, graduating from Johns Hopkins in 1937, followed by a surgical research fellowship at Hopkins and Cushing fellowship at Yale. In 1943 he entered the Army, at first doing general surgery and then reconstructive surgery of many injured hands. After two years as assistant chief of surgical services at Hines Veterans Administration Hospital, he came to New York, married (his wife was also a physician), and started to practice.

In addition to his practice he also continued with teaching and research. In 1956 he reported that he had been on the faculty of the new Einstein College of Medicine and, "of course have been busy interviewing prospective students, working on the curriculum, starting courses, and doing the many interesting things necessary to help start this new venture." He remained on the staff until 1976 and was professor emeritus at the time of his death.

He was the author of many publications, was a member of the American College of Surgeons, American Medical Society, and a founding member of the American Society of Hand Surgery. He is survived by his wife, Jean, a brother, and a sister.—Wyman Boynton, secretary, 668 Middle St., Portsmouth, NH 03801

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Russell Robinson has put together an excellent plan for a mini-reunion to be held in Tucson, Ariz., in April 1994 for five days. He believes the cost per couple (including airfare) would be less than \$1,500. He suggests we stay at the Radisson. It is fairly new, has sheltered patios with gardens, heated swimming pools, close access to golf courses, and other sports. Besides breakfast, the Radisson provides two hours of "happy hour" (drinks on the house).

Each day would have a four-hour sightseeing activity. Afternoons are given over to relaxation, personal reunions, or shopping. We plan two banquets, one with an MIT speaker and one with a University of Arizona speaker. There could be an extension package of three nights

Facing a Collapsed Job Market, Lawrence Berk, '32, Created a World Resource

On April 7, Lawrence Berk, '32, founder and chancellor of Berklee College of Music, received a standing ovation from the Wang Center audience when he was honored as the first music educator to receive the Hall of Fame Award at the Pepsi Boston Music Awards. The following is an excerpt from a Boston Globe article by Berklee alumnus Fernando Gonzalez, first published on March 30.

He hasn't written any hit songs. He hasn't sold millions of records. He is not a big name producer. He hasn't even played Svengali to any big star. In fact, most pop music fans probably wouldn't recognize his name or his face. Yet the influence of Lawrence Berk in popular music in the past 40 years has been both profound and pervasive.

Berk, who will receive the 1993 Pepsi Boston Music Hall of Fame Award, is the founder of the Berklee College of Music, the most important school for contemporary popular music in the world.

"It feels very special," said Berk in a phone interview from his home in Back Bay. "But I feel kind of guilty accepting the award because, actually, it was the kids who came out of the process who made things great."

The list of Berklee alumni is certainly impressive. It includes premier jazz artists such as Pat Metheny, Gary Burton, Joe Zawinul, Branford Marsalis, and Keith Jarrett; pop musicians such as Donald Fagen (of Steely Dan fame) and Bruce Hornsby; rockers such as Steve Vai and Aimee Man; producers

such as Quincy Jones and Arif Mardin. Vocalist Lalah Hathaway and drummer Terri Lynne Carrington, both former Berklee students, will be featured in a tribute performance at the Boston Music Awards.

Berk, 84, was born in Boston's West End. He worked as a pianist while in high school but soon decided against a career in music. He attended Boston University Law School for a year, then switched to MIT, graduating with a degree in architectural engineering. Lack of work in his field led him back to music. He lived in New York work-



ing as an arranger for CBS and NBC and studying with Joseph Schillinger, a composer and theoretician who proposed a mathematical approach to musical composition.

Returning to Boston, Berk started teaching with three students. He opened the school, first called Schillinger House, in 1945 on Newbury Street. "I never expected to start a school at all," said Berk. "Talented kids seemed to find me and I got busier and busier and my best students became assistant teachers and that's how the school started."

The idea of studying the popular music of the time, jazz in those days, with the same rigor that traditional conservatories applied to studying the European classical canon was a revolutionary concept. Then, as now, the school emphasized a practical approach geared to the working musician, and the idea caught on quickly.

A year after it opened, the school had 50 students and by 1966, 450. The name of the school was changed in 1953 and is a reference to Lawrence Berk's son, Lee (who is now president of the 2,700-student college). In fact, with its worldwide reputation, large foreign student population, and regularly scheduled seminars in places such as Japan, Spain, Italy, and Argentina, Berklee is now a global concern.

"It never occurred to me to plan where the school was going," said Berk, "I was just doing what I thought was right. I never expected to have an accredited school and the school would grow this big. No. I never had this in mind." □

to Sedona, Grand Canyon, and ending in Las Vegas—from which we fly home.

We need to reserve 30 double suites. It looks like a great deal. Let's talk it up and act quickly! Write to Tom Weston or Russell Robinson for more interesting details.

Russell also writes that he has just returned from a stay in New Zealand where he visited hordes of relatives and stayed with his youngest child, an apple grower, who lives near the town where his father was born. "It's sure a beautiful country, but it's good to be

back on the desert," Russell says.

Arthur Marshall is successfully recovering from his third operation in three years (hernia, this time). He hopes to be with us on Technology Day in June and at the mini-reunion in 1994.

... Albert O'Neill writes that 1992 was a bad year for him but he feels pretty good now and hopes to join some of his classmates in June 1993 at Technology Day activities. He called to my attention some honors given to Lawrence Berk. (See story this page.) You can see there is no telling where a MIT graduate may go.

I received a most interesting letter from Ben Chadwick. He remembers a chat he had with Professor Charles E. Locke (mining and ore dressing) just before graduation. The professor strongly advised Ben to go out in the world, find a good girl, get married, and have a family because he would be able to give the children a good education. Well, he found Marion and had five children, and they are all well-educated, three with master's degrees. Now Ben and Marion have nine grandchildren and will celebrate 56 years of marriage in June

1993. Our congratulations to you. Since retiring in 1969, they have been travelling extensively—more than 140 places and some twice. If you want some advice on where to go—contact them.

It was not so long ago that I had considerable correspondence with Minot Bridgman. His activities and picture appeared in the January 1993 issue of *Technology Review*. It is with special sadness that I must report he died of cancer on November 9, 1992. Minot served in the U.S. Army in World War II. He continued in the Reserve and retired in 1962 as a colonel. He worked with Metropolitan Life for 33 years, retiring in 1972, and he was active in many civic and religious organizations. He leaves his wife, Norma, two sons, and six grandchildren.

All for now.—Melvin Castleman, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Your secretary hopes that a report on our 60th Reunion will have been broadcast to all classmates long before this date. It is now around May 1, and all of the news that we are receiving, including obituaries, is being sent directly to the campus to be included in the biographies and obituaries for distribution at the reunion.

This is the last issue of 1933 Class Notes to be written by your secretary who is bowing out, believing he is not quite up to the task any longer at 83.—William B. Klee, secretary, P.O. Box 7725, Hilton Head Island, SC 29938

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60th Reunion

Our report this month comes from Carl Wilson, 48 Druid Hill Rd., Newton, MA 02161-0223, (617)527-7088:

"We are saddened to report that our class secretary, Bob Franklin, died at Brigham and Women's Hospital on April 10, 1993, after a rather long illness. Bob was a graduate of Course VI and worked for Sperry Corp. until 1968 when he took early retirement and moved to Cape Cod. He served as an officer of the Cape Cod Alumni Club, and in addition to his class secretarial duties, he was active as an Educational Counsellor and a member of his class's reunion committee. He and his wife, Vivian, who survives him, travelled extensively. Bob was a railroad buff and sought out railroads all over Europe.

"Ray Jewett also passed on this past winter. Ray had been in poor health for many years. He lost his wife, Olga, some years ago. He served in the U.S. Army Signal Corps from 1941 to 1945, retiring as a lieutenant colonel. He received the Bronze Star and Legion of Merit. He started work as a radio engineer for Tropical Radio Telephone Co. In 1937, he joined many of his classmates at Linde Air Products. In 1950 he joined Parker-Hamflin Corp. He retired from there as sales manager.

"We learned the sad news of the death of Edwin Geitmann in a letter from his wife, Mary. She writes: 'It is with extreme sadness I must inform you that Ed passed away on December 29, 1992, after a long four-and-a-half-year battle against bone cancer and heart disease with many strokes. By a coincidence, Mary met one of the girls in her scout troop whom she hadn't seen for 39 years. She was made the head night supervisor of the Menomonee Falls Hospital and she was with

me when Ed died. A real comfort. A very precious person. . . . Now, I am managing Carbonite Metal Co., but without any engineering advice to our customers. Here is a short resume of Ed's activities since he graduated from MIT. His first job was with Chevrolet in Flint, Mich. From there he became a VP of Standard Oil of Indiana in 1938, when I married him. He was in charge of their fleet of cars and trucks and designed their tanks. (Frankly, he was a little put out with me, because I was not interested in tanks and trucks.) From there, because he was too old to be drafted for the war, he went to Fisher Furnace (Industrial Furnaces) then to Lindberg Engineering which bought the Fisher Furnace Co. In 1948, his ex-roommate from St. John's Military Academy, Howard Mullett, asked him to be his partner with Carbonite. He bought it from Howard around 1952. . . . We had a very full life with many travels around the world and we especially enjoyed flying our single-engine Beech Bonanza up to a year before his death. Incidentally, I have a grandson who plans on graduate study at MIT. At present he is a junior at Stanford University—Edwin John Geitmann IV."

"On a happier note, George Gahm, was feted on his 80th birthday by his wife, Gudron, and George's many children, grandchildren, and great-grandchildren. George is still actively practicing psychiatry and works out regularly at local gyms. In honor of the occasion, the family joined together to make a contribution to the MIT Scholarship Fund. An inscribed plaque commemorating the gift was presented to him by his family.

"Vice-President Jim Elder and his wife, Mary, have moved from Chapel Hill, N.C., to Rancho Bernardo, Calif., to be closer to their son, Martin, and his family who reside in San Diego. The move was made somewhat reluctantly as they considered the life in Chapel Hill 'idyllic.'"—John Hrones, president, 9397 Midnight Pass Rd., Apt. 306, Sarasota, FL, 34242-2949; George G. Bull, assistant secretary, 8100 Connecticut Ave., Chevy Chase, MD 20815

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Alice Kimball, president of the class of 1936, sent me the obituary from the Torrington, Conn., paper of Harvey B. Chess III, who died April 11, 1993, in Wellesley. He was chief metallurgist at the Torrington Co., where he worked for over 40 years before retiring in 1978. He divided his time between Wellesley and Orleans on the Cape for the past 15 years. He was an avid fisherman, ham radio operator, and stamp collector. He is survived by two daughters, Joanna Bergson and Loren Chess, both of Orleans; a son, H.B. Chess IV of Westport, Calif.; two sisters, Nancy Chess and Jane Reif, both of Wellesley; three brothers, Robert of Atlanta, James of Pittsburgh, and William of Washington, Conn.; four grandchildren, and two great-grandchildren. I am sending our condolences.

Phyllis Debes, widow of Charles Debes, who died in August 1991, sent her annual Christmas letter "just to keep in touch" and let me know she faithfully reads the Class Notes!

I have been saving a copy of an article in the *Boston Globe* entitled, "On the Passing of the Slide Rule" (which Walter "Stocky" Stockmayer sent to me on a winter weekend when they were inundated with 11 inches of snow) until I had room in this column to send you a condensation as follows. Those of us who used a slide rule know the real difference between the slipstick and the computer is the

that the slide rule was limited as a calculating device. As a result, we were forced to engage a problem with great intimacy. There was no quick, massive trial calculations at a key stroke. We had to know how to add and subtract. We had to use pencil and paper. And we had to do much checking to be sure we were on the right track. In other words, to use a slide rule, we, not some anonymous software writer, had to know what we were doing. "There is a danger that massive computational power at a keystroke can lead scientists and engineers, particularly as students, to a world view that confuses mathematical abstraction with reality," states Thomas A. Stuhlfire in his summation.

I imagine that many of you, like me, are very picky when it comes to finding a chair on which to sit. I prefer a solid chair with a seat about 17 to 18 inches above the floor with two arms. That I can manage with no help. But lower the chair or take away the arms and it becomes a struggle. After reading about the success that some had with an exercise program I decided to celebrate my 80th by joining a fitness club. It works! After 10 weeks of treadmills and weights for an hour every Monday, Wednesday, and Friday, I can get up *no hands*, but it wouldn't work on an airplane.

You owe me a letter, tell me what's with you. Write to—Allan Q. Mowatt, secretary, 715 N. Broadway, #257, Escondido, CA 92025

36

Returning in our camper from Golfo de California, Phoebe and I stopped in Phoenix to see three classmates who moved there since my 1990 visits. Louis Smith (Course X) was busy getting settled at 1160 S. Jokake Street after a temporary stay with his son, Chris. He begged off a visit, but reported that he and Florence are well. He is retired from Union Carbide, where he practiced patent law after graduating Fordham Law School. In 1934 Lou was passenger in my topless Model T on a trip from Cambridge—seven hours over the Boston Post Road and a drizzle much of the way. Strapped to fenders was a broken 12-foot sweep oar, courtesy of rigger Ted Manning. It now serves as handrail on the stairway from our basement garage—Phoebe's idea. Lou was one of the 1936 Class Crew that won the annual Richards Cup race in 1934. They beat the inexperienced frosh, of course, but also the veteran juniors and seniors—and this in spite of the handicap of a jumped slide-seat for several strokes. Stroke Gordon Thomas wouldn't say die, and fired us up with a few choice words.

Leon Simons came to the Institute with an N.Y.U. degree, but did the full tour in Course II. He and Pat Patterson were dorm neighbors. Then he became a creator of production methods and tools—he has some 40 patents, including a "Simons Head" screw, which resists stripping, and a wire-drawing process. His Hydromatic Machine Company won an Army "E" award in World War II. His wife, Nettie, is bedridden, and we could not meet. But daughter Ellen is with them in Scottsdale and rides horseback around the area. She showed Phoebe her mounts in the paddock, and we came away with some home-grown oranges for our remaining journey.

Malcolm Seymour, now in Sun City West, Ariz., came to Tech with a Harvard BS in industrial chemistry. He got an SM in economics in '36; then was in R&D at United

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Shoe, Bolta Products, and General Tire for 25 years. He later founded his own company, Prototypes Inc. He holds 16 patents: strain gauges, sailboat speedometers—variety! Mal was having dialysis treatment the day I could visit, but later on the telephone he spoke of his good health otherwise. Upbeat! The name Seymour derives from the St. Maur homestead in Wales 850 years ago, which Mal helped to restore in 1981. His *Puritan Migration to Connecticut, the Saga of the Seymour Family 1129-1746* tells part of the story.

Roger Krey's "Everybody's a winner" (see last issue) needs a further explanation, to wit: In 1969 Roger, with help from brother Jack, '39, bought a lot adjacent to his lakefront home to keep it open forever. Over the years, the real estate values multiplied umpteen times in this "Golden Pond" area of New Hampshire. Meanwhile the neighbor on the other side of the lot built a sizeable boathouse foundation that violated sideline ordinances, and he sought to buy Roger's lot. The answer: "Go see MIT—I'm giving them the property." The Alumni/ae Fund accepted the neighbor's offer and set up a charitable trust with the proceeds. Roger and his wife, Barbara, receive interest income for life, and capital gains taxes do not apply. So everyone benefited, including the neighbor, the town (higher taxes), and MIT ultimately. Are there other readers with a lot, an antique car—a whatever? Roger wrote: "Nothing I have ever done with money has provided me with as much satisfaction."

Cheers for the life of George Moustakis who died suddenly February 6 of a heart attack while walking his dog. An ardent bowler, he had mowed the pins down only the night before. George was Course XV, spent much of his career on aircraft turbines at GE-Lynn, and won a patent for an automobile suspension system. He retired in 1977. His wife, Marjorie, told of their fun touring the country and parts of Canada and Mexico with a trailer and praised him as "a great father and grandfather." His longtime friends Luis Emilio and Ron Beckman (both Course II) recalled their sailing days off the New England coast in a jointly owned 56-foot ketch. Marjorie continues at 14 Columbia Rd., Danvers, MA 01923, near her offspring.

A *Boston Globe* article, forwarded by Herb Borden, tells of Ed Dashefsky's death April 23. He had been on dialysis treatment for three years and hospitalized nine months. But in his active life it was vim and vigor in all that he undertook. Fortieth reunions will remember the life-and-drum presentation of the Class Gift, which he organized. After retirement as VP of Raytheon, he actively consulted with the chair of the company. And I like the highlight of his 50th Reunion biography: "Being married to my Rose!" Until last summer she was busy in education and counseling at Children's Hospital, specializing in learning disabilities, and other social work. Best wishes to her and a toast to Ed's life and career!

My planned spring trip through the middle states and on to a graduation in Rhode Island had to be cancelled, but I am hopeful some of it can be done in the fall.—Frank L. Phillips, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; James Patterson, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

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Rose and I spent an enjoyable evening with Ruth and Phil Peters and Marge and Dick

Young at Fox Hill Village. Phil and Ruth did not make their annual trip to the PGA National, Fla., but spent the winter at Juniper Hill, their Jackson, N.H., home. They had many visits with their children and younger grandchildren, and Phil says he can still join them on the slopes when the conditions are right. Marge and Dick left New England for Arizona where they not only visited many points of interest, but Dick was able to work on and improve his golf game. Rose and Bob Thorson did not go to Florida, but stayed in Winchester, Mass., where they witnessed the longest, snowiest, stormiest winter in the Boston area since 1978.

Richard (Huck) Ewert and his wife, Lois Ann, live in Saint Paul, Minn., except in April and October when they are in their condo in Naples, Fla. Huck retired on December 31, 1988, as president of the Sewall Gear Mfg. Co. He is a graduate of Illinois College, Jacksonville, and served on the board of trustees from 1966-1973. He was awarded an LLD degree upon retirement from the board. A fourth generation member of the Ewert family is now a student there. Huck is also the author of a book entitled *Gearing: Basic Theory and Its Application—A Primer*.

John Nugent sent an article that appeared in *Vermont Life*. It notes that Phil Dreissigacker's sons Dick and Pete "may not be as famous as ice cream emperors Ben and Jerry, but in the world of competitive rowing the products their company, Concept II, makes in Morrisville are household words.... Their high-tech graphite oars were already standard equipment in boathouses around the world.... The Dreissigacker brothers, both engineers with experience in national and international rowing competition, introduced a new oar last year. The new blade was 20 percent larger than traditional blades.... In the 1992 Barcelona Olympics, rowers using the new Concept II blade won 10 of the total of 14 gold medals awarded." Congratulations!

It is with sorrow that I report the deaths of John Kinley on October 6, 1991; Davis Hamerstrom on January 28, 1993; and Edward Corea on April 11, 1993. John Kinley was also a graduate of CalTech and received an MBA from Harvard. He was chair of the board of the Kinley Corp., a Houston-based firm. Dave Hamerstrom was associated with Thomas B. Benedict, designing schools, residences and other buildings in the Roscoe, N.Y., area. Ed Corea was a regular attendee at our reunions. After graduation he worked for the Navy at the Charlestown Navy Yard, and Quincy Ship Yard, Mass., and was responsible for ship communication systems. He retired in 1976. Ed was a community volunteer. He was a recruiter and coordinator for the retired Senior Volunteer Program of the South Shore, Mass. Our class sends its deepest sympathy to the Kinley, Hamerstrom, and Corea families.—Robert H. Thorson, secretary, 66 Swan Rd., Winchester, MA 01890; Leonard Seder, assistant secretary, 1010 Waltham St., #342B, Lexington, MA 02173

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Clark S. Robinson writes: "I am now thoroughly retired from my Russian translation business. I live in the mountains and devote much of my time to ham radio. (My call sign is NV7W.)"

What he did not add is that following graduation from MIT (SB and PhD) and four years in the Army Signal Corps, he spent 30 years

on the physics faculty at the University of Illinois and, upon retirement from there, he became adjunct professor of physics at Montana State University in Bozeman. Along the way he became involved in the translation of Russian physics, and since 1972 has been editing some of the translation journals for the American Institute of Physics.

Sadly this month we must report the passing of five classmates. From Hal Seykota, '39, comes word of the death of Sylvan Glick on January 20, in Denver. He was a transfer from the University of Denver, receiving both SB and SM in Course VI-A, the EE Cooperative course. At MIT he was president of Phi Sigma Delta. During his professional career he was an electrical and design engineer for General Electric, Sunstrand, Martin Marietta, and Samsonite—retiring in 1982. During World War II he worked on the Titan missile program and was responsible for numerous inventions and patents.

Through Gretchen Birge we learned of the March 19 death of John A. Petroskas of Swarthmore, Pa. After five years at the office of the chief of ordnance during World War II, he began his professional career in the steel industry as chief metallurgist for Midvale Co. Thence he worked for 20 years as the chief metallurgist for Phoenix Steel Corp., from which he retired in 1977 to continue as a private engineering consultant.

James J. Dillon, a graduate of Providence College, took graduate courses in our class in public health. He had served many years as a sanitary engineer for the Rhode Island Department of Health and subsequently as its senior sanitary engineer. After several years as director of research for Berkshire Fine Spinning and then Berkshire Hathaway, he spent 16 years as research chemist for the Owens Corning Fiberglass Corp., retiring in 1985. He died March 11.

We have received notice of the deaths of Raymond Strickland, Jr. on January 23, and Bill Burrall on February 11. Although there was no accompanying information, from reunion books we know that after graduation Bill worked 13 years in electrical engineering and supervisory work with Automic Electric Co. of Chicago. The following 21 years he spent in California with Rockwell International, originating and implementing systems in standards engineering, valve control, and system safety engineering. On the side he spent several years as a para-professional mental health counsellor and had been involved in giving children nature talks and taking them on nature walks.

Do tell us about your comings and goings and hobbies. Further, we'd much appreciate additional information about those for whom we have no information or simply those data we can glean from *Technique* and reunion books.—Don Severance, secretary, 39 Hampshire Rd., Wellesley, MA 02181

39 55th Reunion

Fred Grant, chairman of our 55th Reunion scheduled for June 1994, reports attendance by the '39er core committee at MIT's Cambridge conference of reunion officials on April 14. Classmates present also included Manning Morrill, Joe Dana, George Beesley, and Class President Seymour Sheinkopf. During the conference, they were stimulated to visit with a personable young student who is being helped through MIT by a scholarship originating in the 1939 Class Scholarship Fund. Fred has many cards expressing '39ers hopes to attend

the 55th. Classmates who missed mailing their cards to him because of income tax or other preoccupations, may help the committee confirm reservations by telling Fred now whether they plan to attend.

Ernie Kaswell, class agent, reports that for the year ending December 1992 there were 349 active '39ers who donated \$80,558 to MIT. The median gift was \$100. Ernie summarizes: "The 1939 Scholarship Fund totals \$546,151; its Course III Fund totals \$82,191; and its Library Fund totals \$1,300. During 1992, income from the Scholarship Fund was \$45,155 and it supported eight scholarships."

Every '39er is a member of the MIT Cardinal and Gray Society. C and G activities were outlined on pages 13 and 17 of the April 1993 *Technology Review*. George Beesley is chairman of the C and G and Ruth Pitt volunteered to help. Phone (617) 253-8232 for details about coming events and privileges extended to C and G members. To see who is active in C and G, come to any Tech Night at the Pops. C and G members in their cardinal jackets have seats of honor in the front rows of the Orchestra Section, main floor of Symphony Hall.

Ben Badenoch and Gay resettled in Walnut Creek, Calif. A book titled *Sled Driver* by pilot Brian Shul is about the SR-71, a plane that was flown from Los Angeles to Washington, D.C., in 68 minutes. While visiting with Ben, I learned he made a major contribution in design of SR-71's hydraulic systems. After years of touring in their large RV, Ben and Gay are finding a mini-sized version is comfortable enough and easier to maneuver. Ben designed and built a fixed-wing glider in which he won a California championship for highest average speed over a fixed course. Ben completed his design for a new fixed-wing two-seater self-launching glider. It uses a 40-horsepower engine to get to altitude, after which the engine is turned off and quiet flight is enjoyed. In his spare time, Ben gives talks before Toastmasters and other clubs.

Fred Sheldon wrote his MIT thesis on using hydrogen peroxide (instead of chlorine) in paper bleaching. He is pleased that, during his career, peroxide sales increased from carboy to tank car lots. In New Jersey, Fred plays tennis and corresponds with Burns Magruder. Anne Sheldon is a professional actress who stimulates Fred to travel to Alabama and Sarasota where, for years, she has been complemented by many curtain calls and repeat engagements.

Jim Barton and Mary avoided traditional Northwest April showers by vacationing several weeks in Arizona. After working their in-baskets down, they expect to visit Sid Silber and Jean near Baltimore. Jim reported that a Seattle MIT Forum drew a full auditorium of people intensely interested in Star Wars and space. Jim says the crowd had mastered the whole directory of acronyms invented to communicate about the technology of space.

Bob Atwater, retired from Nabisco, relaxes in New Jersey by gardening and playing his chromatic harmonica, but at separate times.

... Jim Laubach and Ruth retired after a career of activities in machine design. In Brattleboro, Vt., they enjoy the quiet life, and at the time we spoke they were contemplating the coming week's fun of planting vegetable seeds. ... Bob Touzalin and Aletta are arranging a mini-reunion for June in London with Seymour Sheinkopf and Sylvia. Fred Cooke and Eugenia may join them, and if that happens, they'll want the pub piano to be tuned right up to "Concert A."

Bill Pulver and Adie's interest in puzzles is useful as they solve timetable problems regard-

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M. Walbaum, SM '88

ing their continuing travels. Between recent trips to the Caribbean and West Indies, Bill glanced at the May 1993 *Golf Digest* article titled "As though it had eyes" and found a story on golf-ball trajectories analyzed in light of Richard Feynman's statement that a ball always takes the path of least action. For details see the Pulvers at our 55th Class Reunion during June 1994.

Einstein's Dreams by MIT Professor Alan Lightman is a new book about time. It is written as fiction and I recommend it as must reading. I suggest those who read and enjoy digesting its ideas slowly will come to feel refreshed and rewarded.

We are saddened by news of the deaths of six classmates. Richard D. Robbins died January 7, 1993. His wife, Rosemary L. Robbins, wrote from Colorado Springs: "We enjoyed the one trip we took with the MIT Quarter Century Club from Boston to Egypt about February 1977."

Sylvan G. Glick, 78, died in Denver on January 20, 1993. He was president of Phi Sigma Delta Fraternity. His career included work for General Electric, Sunstrand, Martin Marietta, and Samsonite, and he contributed to development of the TITAN missile.

George J. Thomas, Sr., 77, died February 1993, in New Bedford. Professor Thomas taught civil engineering at Dartmouth and SMU. He was a registered professional engineer. For many years he owned and operated the Thomas Department Store in New Bedford.

Irving Peskoe, 75, died February 27, 1993, in Homestead, Fla. He served in World War II and the Korean War. He studied law, and once stopped the telephone company from charging tolls on calls between Homestead and Miami. He was reelected and served three

two-year terms as mayor of Homestead. A new school was named The Irving and Beatrice Peskoe Elementary School. From many columns about and pictures of Irv and Bea, the *South Dade News Leader* summarized: "MIT-educated officer, attorney, elected official, skilled politician, community servant, and occasional tilter against windmills, Irving Peskoe will be remembered as a man who, above all, stood for right and fairness, no matter the cost."

Carl A. Segerstrom, 79, died March 10, 1993, in Winchester, Mass. He retired after 24 years of distinguished service at Hanscom Air Force Base. He was a life member of the Institute of Electronics Engineers, and the American Institute of Aeronautics and Astronautics.

Meredith "Kip" Wardle, 74, died in Seattle on March 29, 1993. His career included work for Curtis Wright and Boeing. He was known for his design of arresting gear to stop planes on aircraft carriers. His wife, June Wardle, wrote: "He built a 28-foot motor sailor. We spent five years traveling twice along the beautiful inside passage between Seattle and Alaska, and on the inland waterway alongside Florida's east coast, and the inland waterway between the Gulf and the Chesapeake, and on to the Bahamas."—Hal Seykota, secretary, 2853 Claremont Dr., Tacoma, WA 98407

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Just received a letter from Class President Norm Klivans regarding the 1995 reunion. Booking at the Woodstock Inn has been confirmed for check-in any time between Mon-

day, June 5, 1995, and Wednesday, June 7, 1995. Departure for Cambridge will be the morning of Thursday, June 8, 1995. Reservations at the Hyatt Regency on Memorial Drive and at the dorms have been made. Reservations for class breakfasts on Friday and Saturday mornings at the Hyatt will be arranged. Other arrangements in Cambridge are planned by the Alumni/ae Association and include a pre-Pops dinner, Tech Night at Pops, and Technology Day activities.

Richard Dreselly, '46, sent me a clipping from the *Maine Sunday Telegram* of February 14, 1993, about a World War II action by Jay Zeamer, Jr., of Boothbay Harbor, Me. Jay received the Medal of Honor for his heroic service as the pilot of a B-17 bomber that was ordered to perform an aerial mapping mission of the Solomon Islands. Just before take-off, a reconnaissance of nearby Buka Passage was added to the mission, as a report showed that 400 Japanese planes had landed there the night before. Jay's plane was attacked by 22 fighter planes. He and his crew of nine fought off the fighters, completed the mapping mission, and crash landed the plane. Six crew members, including Jay, were seriously wounded and one was killed before the mission was completed. The event took place just 50 years ago. Jay says that his crewman's death makes him feel less like a hero.

Leslie A. Sutton of Berwyn, Pa., passed away on February 8, 1993. He was employed as a chemical engineer by Catalytic Corp.

A recent publication by the Alumni/ae Association provided information concerning donations to the Alumni/ae Fund through Fund Year 1991-92. Twenty three of our class members have made lifetime contributions of

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\$25,000 or more. Fourteen made an annual donation between \$1,000 and \$2,999, and forty-five were shown as Great Dome Associates, representing gifts of \$250 to \$999. Total giving during Fund Year 1991-92 by 209 of 378 classmates was \$309,313.

A note from **Joseph L. Mahoney** says, "Enjoying retired life in sunny Ventura, Calif. Traveling to visit with friends and relatives in New Zealand, Australia, Tahiti, and around the United States. Spent a few days visiting MIT and Newport, R.I., my old home of college days."

I appreciate your notes and calls, so please keep them coming to: **Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

41

As befits his stamp collecting hobby, in an envelope covered with four colorful stamps, **Phil Lewis** writes: "Thought you might like an account of the 1993 Florida Mini-Reunion."

"Sue and I celebrated our 50th anniversary in April 1992. At that time our daughter and her husband, Lou and Chuck Powers, gave us a week in their time-share. We decided to use it to visit friends in southern Florida and attend the Mini-Reunion in Naples Jan 4-6, 1993. The reunion was proposed by Norm Klivans, president of the Class of '40, and expanded to include '39, '41, and finally all classes, which really made it special. Attendees were from '35 to '54. I was especially glad to see Alvin Gutag and his wife Norma. I have known Al since 1930, but had not seen him since 1940. I last saw my Lambda Chi Alpha brother, Maurice Taylor, '42, and his wife, Sadie (Flora), during the war. It was a real joy to talk about our MIT days! Ken Rosett, '42 and his wife, Jean, brought back memories of New Rochelle, N.Y. Ken, Al, and I were at New Rochelle High before MIT and we entertained our wives with the New Rochelle Victory song. That's what reunions are all about! **John Mullen** and his wife, Jane, were the only others of our class to make the gathering. Dr. Paul Gray, '54, MIT past president, gave a brief address on Jan 6th. About 60 graduates and guests attended."

The Alumni/ae Association sends word of the passing of two more classmates—**Max Schweinhaut** on November 25, 1992, and **John Brannan** on April 1, 1993, in Sarasota, Fla. I knew Max, a metallurgist, from our joint (Course III/Course X) basic chemistry courses. He was from Attleboro, Mass., apparently lived there all his life, and was president/treasurer of the M.S. Co. there.

John, a civil engineer, transferred to MIT from Ohio State his junior year. His 1966 25th Reunion Yearbook biography provides some details of his career. During WW II he "served in the Corps of Engineers building ordnance plants, included two years in the Manhattan Project. Overseas duty was limited to about eight months in the Philippines and Japan.... Leaving the service as a captain, joined Union Carbide in April 1946...still there.... For 10 years represented the Carbon Products Division, Midwest and South. For five years Sales Manager for this division to the electro-chemical industry...last five years ditto for government market of missiles and aerospace.

Family life wonderful...hectic... Moved 12 times. Now (1966) in ninth house, two self-built. One year traveled 43 weeks! Fortunately my gang qualifies as first class, and have taken advantage of the opportunities. Travel—yes,

too much! Hobbies—boating, golf, tennis, and drink (all amateur status!)." His less informative (to us) newspaper obit indicates that he was a member of the Society of Cutlers of Sheffield, England; Monday Club of Sarasota; and St. Boniface Episcopal Church of Sarasota, Fla. Survivors include his wife, Catherine, two daughters, a son, a sister, three grandchildren, and two great-grandchildren.

All members of the class sympathize with the bereaved families of our deceased classmates.

John Murdock sends a note enclosing his inventive idea to provide safe energy with less pollution. Modules based on nuclear submarine technology would be buried in the seabed, offshore, and supply power to the closest land areas. He will send more complete descriptions of this idea to those interested and would appreciate comments.

C. A. "Joe" Kalman, apparently the only close reader of the May/June class notes, was confused whether **Irv** or **Herb Stein** had died in Arlington, Mass. It was indeed **Irv** and I apologize to **Herb** for switching first names in the last half of **Irv's** obituary. If questioned, **Herb** can always use **Mark Twain's** famous comment, "that the news of his passing had been exaggerated," in this case by your secretary.

Chet Hasert reports that funds in the **Charles S. Butt '41 Crew Shell Fund** remained at \$10,000 during the reporting period December 31, 1992-March 31, 1993. His sampling of classmates indicates that many may not have received his special letter dated November 1992, which detailed **Charlie's** rowing career and plans for the fund. The letter, sent from MIT, may have missed some of you in the Christmas mail or as lists were consolidated at MIT. An updated letter is in the works. In the meantime remember that if pledges of future contributions total \$16,500 by September 1, the shell will be ordered in time for dedication and rowing on the Charles next spring. Pledges can be totally new or a redistribution of your annual alumni gift.—**Charles H. King, Jr.**, secretary, 7509 Sebago Rd., Bethesda, MD 20817; (301)229-4459

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The **Donn Barbers** missed the 1993 blizzard by spending that month in Maui. Unfortunately that's the extent of **Donn's** report. . . . A letter from **Herb Lerner** in the May/June 1993 1918 notes attracted **Art Power's** attention. He says **Herb** should receive a Pulitzer prize for his wit and sensitivity!

I should have reported it sooner, but our class was awarded a 1992 Alumni/ae Association Presidential Citation for our 50th Reunion and reunion book effort. So, once again, congratulations to all who worked on these.

Three obits: **Don Greatorex**, Course II, who was employed by Pratt & Whitney, died at his Tequesta, Fla., home; **Vic Frank**, Course V, at his home in Silver Spring, Md.; and **Charles E. Bossi** on August 24, 1989.

Charles spent many dedicated hours on the local Educational Council for MIT and received the **George B. Morgan Award** in 1983. Along with his MIT commitments, he enjoyed a very successful business career in manufacturing. Upon selling his manufacturing company, **Charles** built a very sound commercial leaseholding company. During his partial retirement, **Charles** became very active in a local country club, contributing many hours in reorganizing, remodeling, and eventually becoming president and a board member. He

also was on the board of directors of several other companies and especially enjoyed helping to reorganize companies into a more profitable position or ultimate sale.

Our sincere sympathy to the families of these classmates.—**Ken Rosett**, secretary, 281 Martint Ave., Tarrytown, NY 10591

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My initial task this month is to enter three obituary notices. **George F. Floyd, Jr.** (Course VI), of Placerville, Calif., died October 5, 1989. . . . **Theodore Gunlock** (Course XV), of Encino, Calif., passed away August 7, 1990. **Ted** was CEO of Dexol Industries in Torrance, Calif. He is survived by his wife **Ruth**. . . . On December 31, 1992, **Earl J. Mathewson, Jr.** (Course II) died in Lincoln, R.I. . . . We extend our condolences to the families of these departed classmates.

Telephoning for the Class Gift turned up these items. **John E. Gayton**, of Las Vegas, Nev., **Virgilio Barco's** "Tute roommate, has undergone knee replacements, with a consequent degradation of his mobility, at least temporarily. . . .

John Peterson, of Des Peres, Mo., is in Indonesia, starting up a consulting office for finance and investment. He already has one in Jamaica, named **John Peterson & Assoc., Ltd.**

According to the *Wall Street Journal*, **GenRad, Inc.**, has finally selected a chairman to succeed **Bill Thurston**, who reached the mandatory retirement age in May 1992, and stepped down from his long-held leadership position.

In Salt Lake City, **Dick Zeamer** retired from rocket engineering with **Hercules** in 1989, but remains active in his consulting business, **Applied Science Associates**. He continues a durable interest in history and writing papers on the analysis of civilizations, which he likens to engineering problems. He also enjoys visiting and travelling with various combinations of his five children.

Siddhi Savetsila writes from Bangkok: "After I left my job as foreign minister of Thailand on August 27, 1990, after serving in this position for 10 and a half years, I was appointed a privy councillor to H.M. the King of Thailand. In the meantime, I am also honorary chair of the board of directors of **Telecom Asia**."

Don't miss next month's sensational story: The Over-the-Hill-in-Albuquerque Gang Infiltrates the Reunion.—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114

44

50th Reunion

From the *Wall Street Journal* we learn that **Norman L. Greenman** has retired as chairman of the **Rogers Corp.** in Rogers, Conn. . . . **Bill Cooley** writes that he is now an activist for reform of K-12 education and a volunteer speaker and tutor in high schools. . . . **Bill Bowman** is looking forward to our 50th Reunion. **Bill** started with the class of 1943, dropped out for a year to earn money for tuition, re-entered as a sophomore in 1941 and graduated with the class of 1944.

Bob Copsey, who has been with the **Air Force Navstar Global Positioning Program** for a long time, was part of the team that was recently awarded the prestigious **Collier Trophy Award**. **Bob** says it is the highlight of his long tenure. . . . **Rupert Burtan**, who went on from MIT to earn an MD at Columbia in 1947, has had a long and varied career. He

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was first with Esso and then medical director with a company engaged in air-base construction in Thule, Greenland. After receiving the master's and doctor of public health degrees from Columbia, he worked for a number of large companies, including Delco, B.F. Goodrich, Amoco and IT&T. Since 1976, he has been in private practice, specializing in occupational diseases and industrial toxicology with emphasis on medical surveillance of people engaged in hazardous material handling. He designs programs to help employers comply with OSHA and EPA requirements. He has lectured at Georgia Tech, University of Kansas, and Colorado State University among others and teaches courses in risk assessment and toxicology at the University of Denver. An interesting and rewarding career.

We have a number of deaths to report. **Andy Schmitz** died on November 21, 1992. He had retired as head of quality control at Charles Pfizer Co. in New York City. . . . **John Townsend** died on June 21, 1992. He had been a landscape architect in Greensboro, N.C. . . . **Peter Leone** passed away on May 26, 1992. He had been a staff engineer in Dynamics Technology for Boeing Helicopters in Philadelphia. Our sympathy goes to all of their loved ones.—Co-secretaries: **Andrew F. Corry**, P.O. Box 310, W. Hyannisport, MA 02672; **Louis R. Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

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Many thanks to all of you who have written and called about a V-12 reunion. Unfortunately, the Alumni/ae Association cannot sponsor this activity, so our collective efforts have been for naught. At the moment, the Association is considering a so-called World War II celebration for the June 1995 Technology Day program, but such an activity is not what we initially had in mind. For those of you interested, there will be a Navy V-12 convention in Norfolk, Va., November 3-7, 1993; details can be obtained from the U.S. Navy Memorial Foundation, Arlington, VA 22209-8728. C'est la guerre!

Our V-12 reunion planning caused us to neglect 50th Reunion planning. Hopefully, we will have some real details to offer you later this fall, as June 1995 is less than two years away.

Not too much news from here. Reverend **John von Hemert** advises that he is spending this summer in Ireland studying ecumenics at Trinity College in Dublin. . . . **Hedley Patterson**, who retired from public works in Woonsocket, R.I., in July 1989, continues active in both the RI and NE Water Work Associations. Hobbies are bird watching and refinishing antiques for his wife's antique business.

Please let us hear from you.—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

46

I was wondering if the other shoe would drop for this column at the time I had planned to leave on a trip back east to see family in New Jersey and to attend my 50th high school reunion. The deadline came just in time, and a bit of news arrived just when I had run out. Just to start, I want to acknowledge **Ted Henning's** letter urging us to participate in our class's provision for this year's Alumni Fund. Ted's a good egg who gets into it, and I hope

you'll dig into your coffers and put in the best you can for our Class Gift.

To start the show, I have received a lengthy report of the life of Father **Earl Dionne** who started with our class, but received an SB in '47 as an aeronautic engineer (XVI), and then an SB in management in '48. You won't find him in our Tech Book, but he's listed in our records. He spent 42 months in the United States Navy in World War II, but desired to enter the priesthood, completing studies at St. Francis and being ordained in May 1958 at St. John Cathedral. He spent most of his years at the Archdiocese of Milwaukee until retiring last September. If you're interested in Father Dionne's full story, I'd be glad to send you a copy.

Next in alphabetical order is a short note from **Ed Bacon**, (five days younger than I) telling of leaving his "winter quarters" in Las Cruces, N.M., to return to the "summer house" in Rehoboth Beach, Del. You might want to look him up. He grew up in Wellesley Hills, prepared at Phillips Exeter, and joined us as an electrical engineer (VI). He retired from the U.S. Postal Service and hopes to visit Tech this fall. . . . Next is **Bill Humphreys** who seems unrecorded, though he is shown in our biography book as an ocean engineer. He grew up in Washington, D.C., and prepared in Pittsburgh. He's "happily retired" in Vero Beach, Fla., and sends welcome to **Clinton Springer**. He's looking forward to our 50th. . . . A very short note from **Lewis T. Mann, Jr.**, chemistry major, who wrote a while back, we think, about his life in the Veterans Administration Lab in Fresno, Calif. He says simply, "950 days to retirement!"

A nice note from **John Norton** (another XVI-er) tells of his retirement from GM seven years ago, after 30 years working on gas turbines, jet engines, rocket engines, and re-entry vehicles. He and wife, Priscilla, live in Greenville, S.C., and play golf and bridge, travel, and dabble with finances and a PC. Last fall they visited another retired V-12er, **Ralph Krenkel** and wife, Connie, now living in Warwick. . . . Another old XVler friend, **Edwin Potter**, who crops up now and then in Westport, Conn., tells us of his consulting part-time when he's not calling square dances and involved in an annual music and dance festival.

Keep a' rolling.—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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Almost no news this month - so we'll wait 'til next month and hope we have more material for our column then. Send news!—**R.E. (Bob) McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Cliff Moss is serving a third consecutive elected term on the Corpus Christi City Council. . . . **Mike Kami** continues offering seminars on strategies, planning, and suggestions for how to compete more effectively. He recently presented a seminar for the American Management Association. . . . **Geraldine Mar Haughey** worked for three years after graduation for the Chicago Department of Public Works. In the next 19 years she had six sons and three daughters. She returned to work and spent 16 years with the San Jose, Calif., Department of Public Works. Since retiring in 1988, she has enjoyed family get-togethers on holidays,

birthdays (30 each year), and special occasions (weddings, graduations, etc.). Her children are spread from Zimbabwe to the Philippines. . . . **Victor Dawson** divides his time between a home in Silver Spring, Md., and another in Dennisport on Cape Cod. He and his wife have 16 grandchildren. He enjoys camping, hunting, and fishing.

As part of planning our 45th Reunion, Judy and **Graham Sterling** invited classmates to their home where plans for the activities were discussed. In addition to committee members, **Stan Shein** and **Irene Kalfon**, **Joan and Al Seville**, and **Mike Oglo** attended the gathering.

Marvin Rosenberg died in 1991. He had a serious heart condition for many years. Marvin was president of Alretta Co. in Boston, a distributor of automotive parts. He leaves his widow, **Arlene Mamos**, and their two sons. One son has taken over the business and the other son is an engineer. . . . **Earl (Gus) Solenberger** died in Virginia. While serving in the Far East during World War II, Japanese forces invading China forced him to be marooned up the Yangtze River for 18 months. He continued in the Navy and, as captain, commanded several vessels. He married his wife, **Marjorie**, in Shanghai in 1938. . . . **Earl Hoyt** died in N.J. He served for three years during World War II. He specialized in Materials Handling and was president of Rapistan for many years. He and his wife, **Elizabeth**, have three sons.

Bruce Gaviller died in Lockport, N.Y. He served in Europe during World War II. For many years he was an engineer at Bell Aerospace Systems. He and his wife, **Elinor**, have three daughters. . . . **Melvin Deroche** died in Portland, Maine. He was a machinist's mate on the USS *Omaha* during World War II. He was a sales manager in the insurance business during his working years, and volunteered to help in soup kitchens in recent years. He and his wife, **Evangeline**, have a son and four daughters. . . . **Nilo Lindgren** died at his home in Palo Alto, Calif. He was co-author of the book *A Century of Electrical Engineering and Computer Science at MIT, 1882-1982*. He leaves his widow, **Pat**.

On behalf of our classmates I extend our sympathy to our classmates' wives and their families.—**Marty Billett**, secretary, 16 Greenwood Avenue, Barrington, RI 02806 (401)245-8963

49 45th Reunion

A reunion kickoff meeting for representatives of all classes was held at the Institute on April 14 with **Tom Toohy**, **Joe Schneider**, **Mickey Ligor**, and **Nell and Fletcher Eaton** in attendance. Joe flew from Boca Raton, Fla., just to attend. Regrettably, **Stan Margolin** was absent due to bureaucratic communication problems. (Preliminary information on our 45th in 1994 has already been sent to all of you from Tom Toohy.)

At this meeting, I had the honor of meeting **John Harbison**, professor of music, whose presence on the faculty is made possible by the Class of 1949 Professorship. Professor Harbison dwelt at length on the impressive amount of musical talent to be found in the student body. One student, a pianist, holds world-class potential according to Professor Harbison.

As I write, I am looking at the program for the 1993-1994 season of the Boston Symphony Orchestra, which notes that the world premiere of Professor Harbison's Cello Concerto will be presented on April 7, 8, and 9, 1994, at Symphony Hall with Yo Yo Ma as cello soloist.

At a quiet moment in the above proceedings, my friend **Mickey** was reminiscing about our 35th Reunion in Bermuda nine years ago and, in particular, about an incident at Horseshoe Beach. Mickey and Pam and Nell and I were stretched out in the sun improving our tans. Mickey had no hat, and the sun was blazing. I suggested making a hat of newspaper. Mickey hurriedly created a hat of sorts and jammed it squarely on his head and down over his eyes. A lady, apparently struck by Mickey's dashing appearance, said, "That's some hat you have there. Did you make it?"

"I did," said Mickey, peering out from the brim. "The sun was so hot I had to do something." "Well," she observed brightly, "where there's a will, there's a way." "Whadda ya know?!" I exclaimed in jest, "That's his real name—Willie Way! Actually, J. Willard Way." "That's an amazing coincidence!" the lady gushed. "Sure is," said Mickey. "But truth is stranger than fiction."

Donald A. Sillers has retired as chairman of the board and CEO of the Peerless Manufacturing Co. in Dallas, Tex. He will remain as a director of the board. . . . **Leonard P. Richardson** writes: "I retired from Lubrizol Corp. (Wickliffe, Ohio) after 30 years. My responsibilities included sales, marketing, advertising, and research in our European lab. Since retirement, I have enjoyed golf, duplicate bridge, and oil painting. Our big decision is whether to move to St. Simons Island in Georgia or stay in the Chagrin Valley (near Cleveland), which is a super place to live." . . . **Joseph J. Sableski** writes: "After 26 years with the Environmental Protection Agency, I retired in 1989. Since then, I have been engaged in playing tennis, bridge, and the commodity markets."

Eugene Skolnikoff has written a book, *Science, Technology, and the Evolution of International Politics*. The dust jacket reads: "From the global reach of television to the danger of global warming, from the green revolution to the massive deployment of nuclear weapons, advances in science and technology have become the most powerful and persistent forces leading to societal change. This is the first comprehensive attempt to show how changes in science and technology affect the world political system, and are affected by it."

Among those offering high praise for Gene's new book is **Lewis M. Branscomb**, director of the John F. Kennedy School of Government, Harvard University. He writes: "Eugene Skolnikoff has long been recognized as one of the leading thinkers about the increasingly important relationship between science and technology and international affairs. His latest work on this subject is, as usual, full of wise and insightful analysis. He speaks clearly and cogently about science and technology issues and the evolving geo-political relationships that are certain to be on the international agenda well into the coming century."—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617)449-1614

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Donald Weston is the principal of Martyn and Don Weston Architects of Brooklyn, N.Y. He was recently named as a fellow of the American Institute of Architects. From the AIA citation: "His career stands as an example of an architect lending his talents toward making his profession of ever-increasing service to society." . . . The MIT Enterprise Forum names **Ken Olsen** the first "Entrepreneur of the Century." The

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Forum's award recognizes "the singular distinction of a handful of 20th century founders who have revolutionized an existing industry or established a wholly new one." . . . Donald Bernitt retired from Boeing five years ago. Since then, he spends time as a docent at the Museum of Flight in Seattle. He also keeps up distance running and competes in Senior Sports Festivals in the longer track distances. His philosophy today: "Life now is as good as it gets!"

Edwin Kruse recently visited Honduras. He observed that downtown Tegucigalpa had terrible air pollution, much poverty, and military presence in most places. He indicates that the potential for environmentally sound development is being ignored in favor of 1980s style greed-development projects. . . . We have received notice of the following deaths: Clarence Picard of Capitola, Calif., and Aaron Glickstein. Let's hear from more classmates who have interesting hobbies, trips, or changes in their life-style after retirement. Keep the news coming.—John T. McKenna, secretary, P.O. Box 146, Cummaquid, MA 02637

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Returning with his wife, Sue, from a five-month business trip to South Africa, Richard Hodgson, Jr. feels that they are a very interesting people, with a lot of major social and political problems that will be very difficult to solve. . . . Formerly president and CEO of the Arkwright Mutual Insurance Co., Fred Bumpus is now chairman of that Waltham, Mass., organization. . . . Our class has its own Johnny Appleseed. For many years Charles W. Ter-

rell has been planting trees throughout Georgia. The more-than-a-million trees that he has planted make breathing much easier and more of a pleasure. In 1992, he gave a 1,000-acre tree farm to the University of Georgia's school of forestry. He purchased a 1,000-acre "Shooting Preserve" and promptly renamed it "Wildlife Refuge—No Hunting." Deer, turkey, quail, ducks, and geese all roam freely and safely through that area. While we worry about our environment, Charles is actively improving it each year.

There is some sad news about the loss of a number of our classmates. On February 12, 1993, Sheldon B. Spangler, Jr. passed away from cancer. Denny's most recent legacy was the development of the vision to guide what his home city of Los Altos to what could be in 20 years. He had been mayor and for years a member of the city council. He enjoyed the respect and love of those in his city for the many ways in which he helped those whose lives he touched. Denny, born into a Navy family in Panama, obtained bachelor's and master's degrees at MIT. After a three-year stint in the Navy, he settled first in Arizona before coming to Los Altos in 1962. His four daughters were all brought up in Los Altos. He was president of Nielsen Engineering in Mountain View for over 20 years before becoming program manager at AeroTherm Corp. His entry into Los Altos politics was, in his words, "to give something of himself back to the community that had given him so much." He served on the city council and subsequently became mayor. Previously, he had been on the Los Altos Planning Commission and led the plan review in 1987. He was also the representative to the Association of Bay

Area Governments. He was the founder of Los Altos Tomorrow, an organization concerned with the city's future. Involved in youth activities, he was the coach of the Arrow Track Club for 11 years. Denny had an interest in old clocks, created plywood jigsaw puzzles, was a wine taster, and avid bike rider. We extend our condolences to his wife, Louise, to their four daughters (Anne, Amy, Betsey, and Sarah), to their families, and to the entire community whom he loved and was in turn loved so very much.

In December 1991, Gil Clarke of Gladwyne, Pa., passed away. We extend our condolences to his wife, Barbara. . . . Another class loss was William R. Hewitt of San Jose, Calif., in March 1993.—Martin N. Greenfield, secretary, 25 Darrell Dr., Randolph, MA 02368

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Progress for Burt Richter means going from Z to B. As director of the Stanford Linear Accelerator Center, he has been presiding over research on Z particles; now he is seeking funding for research on B mesons to enable SLAC to continue as a leading research organization. I know no more about B mesons than I do about Z particles, but in what I trust is a newspaper over-simplification, it is stated that the origins of the universe may be understood by watching B mesons decay. I am glad I do not have to go about begging, "Just let us have a couple of hundred mil and we will tell you how the universe started." Fortunately, SLAC has the support of the local members of Congress. Unfortunately, Cornell is competing



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TR92

for the same project, and has the support of its senator....Burt is also president-elect of the American Physical Society.

Wade Greer writes that he is interested in the proposed Far East mini-reunion in the fall of '94. Wade is chair of the board of Wire Belt Co. of America, where he has worked since 1965. After living in Massachusetts for 33 years, he and his wife, Barbara, now live in Alton Bay, N.H. Four of their five children also live in New Hampshire, while a daughter lives in Duxbury. They have six grandchildren, and Wade says that he does not attempt to keep up with the 9- and 10-year-olds on Loon Mountain after three years of ski racing. Wade's company has been on a 4-day, 40-hour week for over 20 years; he, however, now works 3 days per week.

Jim di Vito says he plans to retire this year from New England Electric after a 41-year career. . . . Swraj Paul continues his public service, becoming president of the British Iron & Steel Producers Association next year.—

Richard F. Lacey, secretary, 2340 Cowper Street, Palo Alto, CA 94301. E-mail lacey@hpl.hp.com

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Please send news for this column to: Gilbert D. Gardner, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

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40th Reunion

Planning for our 40th Reunion is well under way, with a reunion committee hard at work and with several meetings of the group resulting in agreement (more or less) on the general outline of the festivities. Committee members are Bob Warshawer, reunion chairman and class treasurer; Joe Blake, class president; Francis Laplante and Herb Slater, class VPs; Ed Eigel, class secretary; Dom Sama, class historian; and Bob Anslow, Wally Boquist, Bob Evans, Paul Gray, Dave Howes, Dean Jacoby, Sam Losh, Chuck Masison, Leon Michelove, Phil Sayre, George Schwenk, and Harvey Steinberg. If you have ideas or would like to help, let me know. By now, you have probably received a letter from Bob Warshawer outlining the reunion schedule. To keep the key dates in mind, note that activities start on Wednesday, June 1, 1994, with a reception at the home of President and Mrs. Vest, followed by dinner on campus (probably). We will stay in Cambridge through Friday, June 3, and then move on to either Cape Cod or the coast or southern Maine for Saturday and Sunday.

Several items of items of interest have been gleaned from those attending the committee meetings. Joe Blake reports that he and Eileen now have 12 grandchildren—five boys and seven girls. They visited Bermuda in April, the "Land of the Midnight Sun" in June, and still need another vacation. . . . Bob Evans is teaching in a Japan-based executive MBA program at the University of Hawaii this summer. His youngest daughter toured Chile in June with the New England Conservatory Youth Philharmonic, and enters Harvard this fall. Bob is the Atran Professor of Labor Economics at Brandeis University. . . . Chuck Masison owns a growing rental business in Foxborough, Mass., concentrating on tool rentals and party rentals. He is a director of the American Rental Association, a VP of the local chamber of com-

merce, and chairman of the Industrial Development Commission in Foxborough.

Phil Sayre has completed his fourth year on the MIT Alumni/ae Board of Directors. He has been working with the MIT New York Center where arrangements have been worked out to affiliate the Center with the Princeton Club of New York. Those of you in the New York area have probably received notice of these new arrangements by now. . . . Joe Blake reminds all of us to keep the Class 40th Reunion Gift in mind—and do something about it!

From Ron McKay comes word that he and Sally are visiting their son Ken, daughter-in-law Angie, and grandson Kevin in Okinawa this summer, as part of trip to China and Japan. . . . Steve Lirot reports that he has retired from his position as director of product safety at Nestle USA. He is living in the mountains of western North Carolina, in a new home he and his wife built in Laurel Park. The Lirots have three children and seven grandchildren.

We are very sorry to have to report the deaths of two classmates. Fred Bowis died last February of Alzheimer's disease in Chevy Chase, Md. He had retired in 1991 after 36 years with Chevy Chase Cars, Inc., a company founded in 1939 by his father. Fred was very active in civic and business affairs in the Bethesda/Chevy Chase region over the years, and received many honors and citations for his work. . . . And Abraham Perera died last February, in Summit, N.J. He had worked for many years as a consulting engineer in Hackensack and in New York City, and was a violinist with the Metro West Orchestra of West Orange, N.J. Our sincere sympathy goes to the Perera and Bowis families.—Edwin G. Eigel, Jr., secretary, 33 Pepperbush Ln., Fairfield, CT 06430, fax (203) 576-4983

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Please send news for this column to: Co-secretaries: Roy M. Salzman, 4715 Franklin St., Bethesda, MD 20814; James H. Eacker, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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Russell L. Schweickart, our astronaut who made the first manned flight of the lunar module, was inducted into the New Jersey Aviation Hall of Fame (AHOF) and Museum on May 6, 1993. Russell will be presented with a bronze plaque and will join the 83 previous inductees in a display at the AHOF education center near the control tower at Teterboro Airport. Russell flew and tested the lunar module before its historic landing on the moon and also spent 45 minutes outside the spacecraft. He was the backup commander for the first Skylab mission. Russell was a jet fighter pilot before he became an astronaut. He has been active in both science and government since hanging up his astronaut wings.

Robert MacDonald, Jr., is a project manager at Gulfstream Aerospace on the new G5 business jet. He is located in Savannah, Ga. . . . Arthur Sirkin has taken a patent exam review course and examination and has become registered as a patent agent to practice before the U.S. Patent and Trademark Office. The opportunity is available to anyone qualified as described in "General Requirements for Admission to the Examination for Registra-

tion to Practice in Patent Cases before the U.S. Patent and Trademark Office."

Please send news to Ralph A. Kohl, co-secretary, 54 Bound Brook Road, Newton, MA 02161

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Alex Bernhard has become a member of the board of directors of the Massachusetts Eye and Ear Infirmary. He continues as a senior partner at Hale & Dorr. . . . Sidney Mank writes from Washington, Va., that he is still holding his own healthwise and is active in community affairs along with his wife, Dorothy. They enjoy the proximity of their son Andrew, an architect, and his wife, Sally, who runs a housing corporation. They now live in the next county, only half an hour away. . . . Larry Young is in his second year of astronaut training and looking forward to the Spacelab Life Sciences 2 shuttle flight late this summer.

Joel Schiffman is practicing orthopedic surgery in Alexandria, Va. He expects to retire in two or three years and do more sailing and traveling. . . . Thomas Whitehouse continues at Standard Air Tools. He has switched from VP for manufacturing to VP for sales. . . . Jim Simmonds has been elected a Fellow of the American Society of Mechanical Engineers. ASME cited his "significant contributions to the understanding of the behavior of plates and shells." He has done theoretical research on large spinning disks and curved membranes and on the development of a 15-inch container to carry mice aloft in a high-altitude balloon. Jim is a professor and chair of the Department of Applied Mathematics at the University of Virginia, Charlottesville.

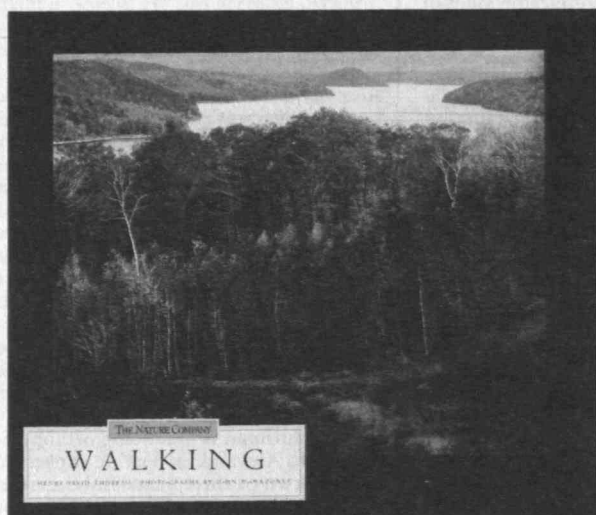
Don Norman has published another book. His latest is called *Things That Make Us Smart: Cognitive Artifacts as Tools for Thought*. The book deals with the interaction between the human mind and the tools we develop to extend our cognitive powers. It has been published by Addison-Wesley.—John Christian, secretary, 23 Fredana Rd., Waban, MA 02168

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As I write these notes, the 35th Reunion is just two weeks away and from all indications it will be (now, will have been) a big turnout! We received this note of encouragement from Dick Wick about the site of our 35th Reunion: "Your choice of the Black Point Inn was a good one. I visited friends there and can confirm that it's a very pleasant place with superb food. It seems as if we have had a schedule conflict for the last four reunions and this year is no exception. We will be observing our oldest son's graduation from the Yale School of Management. By 1998, the nest will be empty and we look forward to the 40th—which we hope will continue our off-campus tradition."

Among those we wish could have attended are Joyce and Louis Seigle, but Joyce wrote to tell us that Louis had passed away following heart surgery. She spoke of the wonderful times they had at the Martha's Vineyard reunions and hoped we all had a great time in Maine. Lou had been a stockbroker with Prudential Securities for the past nine years and president/founder of Marble Industries. We

Visionary Saunterers



Henry David Thoreau delivered his lecture, "Walking," on many occasions. It was not published until after his death, appearing in the *Atlantic Monthly* in 1863. This year it was reissued (albeit abridged) in a rich, fabric-bound volume illustrated with the photographs of John Wawrzonek, '63.

The photographer shares Thoreau's deep affection for the New England landscape and his belief that the transcendent illuminations of nature can be found in the observation of particulars. Wawrzonek's images are a spiritual match for Thoreau's philosophical perambulations. And the book is opulent, with full-color presentation by the Nature Company of Berkeley, Calif., satiny paper, embossed leaf designs, and landscape-detailed page numbers.

Wawrzonek, who holds both undergraduate and graduate degrees in electrical engineering from MIT, took up photography 19 years ago while working in engineering and marketing at Bose Corp. in Framingham, Mass. He now operates his own gallery and fine-art printing company in Worcester, Mass.—*Susanne Fairclough* □

I have met with but one or two persons in the course of my life who understood the art of Walking, ...who had a genius, so to speak, for sauntering: which word is beautifully derived "from idle people who roved about the country, in the Middle Ages, and asked charity, under pretence of going à la Sainte Terre," to the Holy Land, till the children exclaimed, 'there goes a Sainte-Terrer,' a Saunterer—a Holy-Lander.



Of course it is of no use to direct our steps to the woods, if they do not carry us thither. I am alarmed when it happens that I have walked a while into the woods bodily, without getting there in spirit.

extend our sympathies to Joyce and their daughters, Arden and Lindsay.

A note from John Frankle arrived saying, "Last autumn, I and my wife, Rena, made a two-week trip to New Mexico and looked up our classmate Art Bankhurst and his lovely wife, Lois. We had a great evening and enjoyed renewing our friendship after a 35-year intermission." . . . Out on Nantucket Island, Carl Borchert observes, "Karen and I are alive and well, and our kids are grown and gone! (Maybe there is a correlation there?) Still concerned about potential for storm surges and sea-level rise. Regards to all classmates on the mainland!"

That's all for now. We'll have a first-hand report on the reunion in the October issue.—Mike Brose, secretary, 75 Swarthmore St., Hamden, CT 06517

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35th Reunion

Reunion planning for '59's 35th is moving ahead, so mark your 1994 calendar for early June, now less than a year away. Keep reading this column for specifics, as Reunion Chair Jack Fischer and his able committee are in the final stages of pinning down all of the specifics.

Congratulations to Lynd Blatchford who assumes the position of president of Pentad Corp., a pension and benefit consulting firm in Waltham, Mass. Lynd has worked for the company for more than 17 years, most recently as executive vice-president and treasurer and head of the systems department. . . . Kudos also to D. Karl Landstrom, recently appointed deputy director of the Residential Gas Technology Center at the Battelle Institute, which is spon-

sored by the Gas Research Institute.

I've recently had a several good contacts with classmates. Dick Sampson and I had lunch recently, and it included a tour of Dick's very impressive facility in Arlington, Mass., home of his thriving company, American Alarm and Communications. The facility, once a police station, is very well preserved and includes some original jail cells (not currently occupied). Dick occupies the former chief's office. Geared to provide high-level protection to both residential and commercial facilities, the company is a state-of-the-art operation and has achieved UL certification. Turns out that Dick and spouse, Betsy, who live in Winchester, are bicycle enthusiasts as well. They have explored a new bike path that runs from Cambridge (Alewife Station) to Bedford and terminates near our house.



My desire for knowledge is intermittent; but my desire to bathe my head in atmospheres unknown to my feet is perennial and constant. The highest that we can attain to is not Knowledge but Sympathy with Intelligence. I do not know that this higher knowledge amounts to anything more definite than a novel and grand surprise on a sudden revelation of the insufficiency of all that we called Knowledge before—a discovery that there are more things in heaven and earth than are dreamed of in our philosophy. It is this lighting up of the mist by the sun. . . .



So we saunter toward the Holy Land, till one day the sun shall shine more brightly than ever he has done, shall perchance shine into our minds and hearts, and light up our whole lives with a great awakening light, as warm and serene and golden as on a bank-side in autumn.



Also, I chatted with Alfredo G.F. Kniazze at an annual dinner in the Fiji (Phi Gamma Delta) House on the Fenway. Al continues his career at Polaroid with exciting work on a new film product that replaces traditional X-rays, has been involved in helping the fraternity with some current needs, and is a dance enthusiast as well.

That's all for now. Again, I urge you to actually do it—send an update which will be much appreciated by your classmates!—Dave Packer, president, 31 The Great Road, Bedford, MA 01730, (617)-275-4056

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There is very little to report this issue, so I plead again for your help in keeping this column

alive. I can't yet regale you with tales from Albania, but promise to do so in the next issue (particularly, if I have nothing else to report).

I have no information on classmates being appointed to the upper echelons of the Clinton administration, although I have heard the name of one of our own mentioned for a high position. Perhaps there will be more to say about this the next time.

I did receive word that Kenneth Myers, a partner in the Philadelphia law offices of Morgan, Lewis, and Bockius, recently was honored as a coauthor of *Environmental Law Practice Guide*. The guide was named best law book of 1992 by the Association of American Publishers. Congratulations, Ken!—Frank A. Tapparo, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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Please send news for this column to: Andrew Braun, secretary, 464 Heath St., Chestnut Hill, MA 02167, e-mail: Internet: andrewb820@aol.com.h

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Again we seem to have reached the spring doldrums as far as news from classmates. The only message via e-mail since the last newsletter comes from Roger Sullivan, and an obituary of Jim Ross from the *Washington Post* was sent by Charlie Weller.

Roger and his wife had dinner with Jim



John Castle (third from right) poses for the camera with his fellow adventurers, their Twin Otter airplane, and their stage-prop "pole." They then set off to clamber over the pressure ridges in the ice (above) that separated their landing site from the point at exactly 90 degrees North.



A TEST AT THE TOP OF THE EARTH

Experiments are usually conducted to verify theories that are in question, but any Tech Tool knows there's fun to be had conducting experiments that demonstrate well established phenomena. Consider, for example, the coriolis effect: in the Northern Hemisphere, water swirls clockwise down a drain; in the Southern Hemisphere, counter-clockwise. John Castle, '63, was thinking about that on a cruise to the Galapagos Islands several years ago, and he wondered what would happen to water going down the drain at zero degrees latitude. So he observed water exiting his shipboard sink as the vessel crossed the equator. His conclusion, "The water kind of rolled over on itself. . . first in one direction, and then the other."

When he travelled to the north pole

last April with a seven-man party—placing them among the fewer than 800 people worldwide estimated to have stood on the pole—Castle wanted to test the coriolis force at the point where the earth's velocity approaches zero. To prepare for an experiment, he cut a Poland Spring water container to form a rough sink and tested it at home in New York City, packing another plastic jug to carry his water supply.

Departing civilization at Resolute Bay in Northern Canada, the party touched down briefly on the ice at the magnetic north pole, 77 degrees North, just west of King Christian Island. The compass needle wavered, but did manage to point essentially straight down. The group proceeded to Lake Hazen in northern Ellesmere Island, and after one more landing at an ice-flow fuel cache, they finally landed at 89 degrees, 59 minutes, 49 seconds North, or about 1,100 feet from the pole.

The adventurers slogged around

open water and 15-foot-high pressure ridges of ice to their final destination, in temperatures of 30 degrees below zero, with Castle carrying his jug of water inside his parka. When he got the "top of the earth," and ran his test, he found that water rotates even more briskly clockwise down the drain at 90 degrees North than it does in New York at 40 degrees.

Castle reports that the ice on which they landed drifted some 2,000 feet during the hour and 20 minutes they were at the geographic pole, and the extra fuel cache had drifted 10 miles across the Arctic Ocean in the 24 hours between drop-off and pick-up. He credits their heretofore-unheard-of accuracy in determining their positions to the use of an Argosy transmitter left at the fuel cache and a Global Positioning System (GPS) receiver on the plane.

—Susan Lewis □

Ross and his wife, Elaine, in December, and discovered that Jim had terminal cancer. While it was sad to learn of the prognosis, Roger was pleased to be able to say good-bye to his good friend and our classmate. We should all be so fortunate to have an opportunity to visit with those we care for before they leave us. Jim passed away March 21, 1993.

Roger is fine and is leading a productive life as a research manager at the Environmental Research Institute of Michigan, working for classmate Jack Walker, executive VP of the institute. Roger's field has switched from X-ray astronomy to synthetic aperture radar. His wife, Susan, is a crisis counselor in Ypsilanti. Their son, Andrew, graduates this year from Yale with a major in economics and East Asian studies. Andrew spent his junior year in Kyoto, Japan, and Roger and Susan went over to

visit with him during his stay. Their daughter Barbara is a freshman at Oberlin, studying chemistry and music. Their youngest daughter, Cathy, is a sophomore at Huron High School, Ann Arbor, planning to become a herpetologist. Roger assures me that this comes from a scientific interest in reptiles unrelated to the religious aspects of snake handling we sometimes learn of here in the Bible Belt. My son once took an interest in reptiles, so I can empathize with Roger and Susan when they discover the friendly creatures crawling around the house. It really gets interesting when you need to raise grubs, crickets, and mice for live food for the family pets.

My professional activities reached a high point this past February (1993) when I got to present the president's address at the annual meeting of the Mineral Economics and Management Society in Reno, Nev. I also served as

program chair for the two-day meeting and editor of the published proceedings. Now I become an elder statesman for MEMS and continue on the board as past-president. In addition to MIT1962, I also manage the MEMSNET e-mail list for the society.

And while I'm on the topic, please note if you have an e-mail capability that will connect with Internet, and haven't done so, please subscribe to MIT1962. You may join the network by sending the message text: SUB MIT1962 to listserv@mitvma.mit.edu on the Internet system. If you can't figure that out, just send a message to MIT1962@mitvma.mit.edu or to 0004241803@mcimail.com and we'll put you on the e-mail network. As always, even if you don't use high-tech communications, just send a note or card via the U.S. Postal Service to: Hank McCarl, secretary, P. O. Box 352, Birmingham, AL 35201-0352

I think you folks must be sad to see I'm retiring from "secretarying." You sure have sent plenty of notes lately, and I appreciate it.

Roger Hinrichs sent his regrets at not being at the reunion. It seems he is spending the year at Oman's new (six years old) university. "Oman is as warm as the weather—85 degrees in March," reports Roger. . . . From Los Altos, Calif., word from Sal Cagnina, who has spent his career in the semiconductor industry, lately at Advanced Micro Devices. He says, "the...industry has evolved into a highly competitive [one] where long hours are the norm. I've certainly put in my share...but I enjoy the pace." . . . Calvin Yee, with son Edwin, '93, and daughter Wendy, '92, recently helped start the MIT Club of Eastern Ohio. . . . Ronald Eng Young works for Envoy Systems in Waltham, Mass.. Their software connects laptop-based sales reps with corporate databases and stationary users. He has a son and daughter at Harvard. . . . Alan Marty lives in Indiana and ruminates, "I am doing more work and receiving less income each year." . . . Tom Taylor lives in New Jersey with his "college pin-mate and wife of 29 years, Barbara." They have a son at Brown University and two sons who both practice EE. Tom heads energy systems technology at Bellcore, doing long-range planning for emergency power for telecommunication services and platforms. He edits an IEEE publication on the subject and helps run an annual telecom energy conference.

Harry Overholtzer writes he has never before contributed financially, but is now moved to do so. It was the chance to become a member of the Fassett Society. Harry recalls "an approachable man with a sense of humor who . . . helped put one bewildered and intimidated 17-year-old freshman at ease in 1959. To commemorate [Dean] Fassett in the form of the Fassett Society is entirely appropriate." . . . Ron Baecker has written and edited *Groupware and Computer-Supported Cooperative Work*, published by Morgan-Kaufman publishers of San Mateo, Calif. . . . A further update on Fran Dyro, from whom we heard a couple months ago, who tells us she is still working on her murder mystery and consulting on health care issues in Eastern European nations. . . . Albert Pirone is retiring after 25 years as a senior research chemist with ICI America, but is looking forward to a new career in October.

Finally, Tom Parr tells us he is a senior scientist for geology and remote sensing at TASC in Reading, Mass. Last year he worked on a project to help design the America³ yacht. Thanks for your notes.—Phil Marcus, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (410)-750-0184, CompuServe: 72047.333, or Internet: 72047.333@compuserve.com

30th Reunion

"Summertime, and the livin' is easy." I hope that you are all enjoying easy living. There is some hope that the last of the snow in Vermont will have melted by the time you read this column, but as of mid-April when I am writing it, it's not obvious that it will. The key question on my mind right now: will the 16th green ever be seen again?

On to the news. Christine Goddard, daughter of John Goddard, is scheduled to have graduated from MIT this year with a degree in

chemistry. She was in the process of deciding between Harvard and Stanford for graduate school. John, himself a Course V grad, is with Praxair, Inc., in Tonawanda, N.Y. . . . Don Silversmith continues as associate dean of engineering at Wayne State University, where his primary responsibilities include Wayne State's 1,500 graduate students, its off-site graduate programs in greater Detroit and overseas, and its faculty research activities. Don's older son, Jol, has finished his junior year at Harvard concentrating in government, and his younger son, Galen, is going into his last year in the science magnet program at Montgomery Blair High School in Silver Spring, Md.

My immediate predecessor as class secretary, Steve Schlosser, sent me a note providing a status update on various and sundry Schlossers. Steve is senior VP at Prospective Computer Analysts, Inc., in Roslyn, N.Y. He and Lois have now been married four years—the descriptive adjective Steve used is "terrific." Older son George is now "out in the world" as a computer specialist for EDS. Younger son Lewis is going into his senior year at the University of Maryland, and he would like to be a psychologist.

Speaking of predecessors, the model to date for the class secretary's position has been two five-year terms and then "au revoir!" Come June, I will have completed my second five-year term. Anyone interested in taking on the task of recording years 30–40 of the Class of '64's lifespan is encouraged to submit his/her name as a candidate, prior to our reunion, when elections will be held. . . . Meanwhile, keep your news items coming.—Joe Kasper, secretary, RR 2, Box 4, Norwich, VT 05055

Gary Rose called. He continues as VP of flight information operations at Jeppesen Sanderson in Englewood, Colo. For those of you like me, who are not pilots, Jeppesen provides the printed maps, tables, and databases that pilots use to define the airlines they may use and to navigate. It is quite a different publishing business, since he often has to get a new release ready to distribute within days of its availability.

Gary worked for Boeing, Pan Am, and Seaboard World Airlines before joining his current company in 1985. When it was sold in 1987 to its current owner, Times-Mirror, they moved to Colorado. "I miss the oceans, but not enough to be living next to them—we love Colorado." Daughter Kristin moved back to Seattle where she grew up, son Jeff (21) is out on his own, and daughter Kari (age 9—Gary and his wife had the proverbial second family) is at home. Gary travels regularly—his wife of many years is a travel consultant and he gets to go along on many of her trips.

Last month I started the saga of Billy Roeseler. No more had I mailed the column to MIT than I received a fascinating packet from Billy on Kiteski. After working for Boeing and United Technologies for many years, Billy joined Bill Koch's America³ racing team as quality control manager. Billy's background in composites and materials turned out to be a critical element in their success. Before he joined, Koch had broken two masts, and after he joined there were no critical materials failures.

After the America's Cup race was over, Billy wanted to start a company making high-performance composites. Somehow this resulted in a carbon epoxy, Spectra nylon kite which one flies as one water skis. The result is a

high-speed (40 knots), environmentally sensitive new sport. Billy displayed the Kiteski at Technology Day outside Kresge. They've got a great videotape. I'm just sorry I'm such a lousy athlete that I can't try it myself. Billy is also working on a fast-production sailboat, which he believes will be the next fad in the tradition of the Windsurfer. He says he's having as much fun as singing "Old Man River" with Joe Dyro in the elevator of Walker Memorial, but expects it to be more profitable.

Billy splits his time between San Diego, Seattle, and Maui. With his second wife, he has enlarged his family from three to six, and when I spoke with him recently they had their 5- and 8-year-old grandchildren in for a long stay.—George McKinney, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167; (617)890-5771; fax: (617)890-3489

Dr. Thomas McDonough's *Space Adventure* was the only software listed in a *Business Week* cover story on "best products of 1992." *Space Adventure*, which Tom wrote with another MIT alumnus, Buzz Aldrin, ScD '63, is one of the best-selling educational software programs in the United States. Tom is currently also a lecturer in engineering at CalTech and coordinator of the Search for Extraterrestrial Intelligence at the Planetary Society. . . . Dennis Jedlinsky and his wife, Bev, have recently moved from Massachusetts to Southbury, Conn. Dennis has been with Duracell for 18 years, currently as controller of the New Products and Technology Division. That division is developing a line of rechargeable battery packs based on nickel metal hydride technology. Son David graduated from MIT in EE in '89 and two daughters are in college in Louisiana and Georgia. Someday I am going to get some survey results on how many of our class have sent their children to MIT. It's a recurring theme in the notes...along with my constant petition for news.—Eleanore Klepser, secretary, 84 Northledge Dr., Snyder, NY 14226-4056; e-mail: vismit66@ubvms.cc.buffalo.edu

Please send news for this column to: Charlotte and Jim Swanson, co-secretaries, 878 Hoffman Terrace, Los Altos, CA 94024

This is the last column we write before our 25th Reunion, although you will read it after the reunion. We are thankful for the opportunity to have served you over these years (with help from Rick Lufkin, who filled in for us last year when we were in Japan). The legendary Youngest Child at the 25th Reunion contest has attracted a lot of interest, and we have one last minute entry: just five days short of their 26th anniversary, Pat (Saunders, who entered with our class) and Bob Moore became parents "at last." Laura Elise was born at 3 1/4 pounds and, at the time of their undated note, was a "healthy and delightful" 14-pounder. Bob is now full professor and graduate advisor in mathematics at the University of Alabama.

Actually, in announcing the contest, we never specifically limited entries to *children* of classmates. We say this as we are about to report

the first birth of a *grandchild*, perhaps a sign that we are not as young as we used to be. Tom Griswold reports that his grandson, Haydon Griswold, was born in March 1991. He also reports that he and Rebecca Meacham were married in 1989. Tom had three vertebrae in his lower back fused in March 1991 and recovered to receive a fifth degree blackbelt in Kempo in March 1992. Having also survived a lay-off from his state job in 1989, he now works as a consulting environmental geologist and teaches Kempo at his own dojo. . . . Paul Ware recently joined Safety 1st, Inc. in Chestnut Hill as director of quality assurance. Carol and Paul still reside in Stoughton and their daughter, Jennifer, is a sophomore at BU. . . . Back inside the Beltway, Jerry Grochow reports "same house, spouse, kids (Rebecca, 14, and Josh, 10), job (sort of)." He has added title of chief technology officer at AMS and director, Center for Advanced Technologies, but now he has to set up the center in addition to previous responsibilities.

Back in Mike's hometown of Newton, Alan Pollack is still practicing psychiatry and psychotherapy. When he wrote the note, he was

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waiting with his daughter, Lisa, for college acceptances to come—we hope you had good news. . . . Stephen Kanter worked with a comparative constitutional law professor from Denmark and a Sri Lankan human rights lawyer to help Kazakhstan develop its new constitution. . . . From Anchorage, we received a long letter from Phillip Paul Weidner updating us on the past two decades. After graduating from Harvard Law School, he moved to Alaska in 1972 and started his own law firm in 1976. He specializes as a trial lawyer in major criminal defense cases and as a plaintiff's attorney in catastrophic injury cases. He lives in a post and beam/log structure that he built on a mountain-side overlooking Cook Inlet. His next project is a log cabin on a 160-acre homestead near Mt. McKinley. Ana Cristina is in her fourth year at Berkeley and Phillip Thor, who along with his father is an avid steelhead fisherman and duck hunter, is a sophomore in high school. Phillip is also part owner of a naturalist lodge in Costa Rica, which is a mecca for birdwatchers and other naturalists.

From Brussels Ken Morse writes that Laura and he have been living there almost a year and regularly see Patrizia and Lenny Schrank. They've started the MIT Club of Belgium, one of whose events last year was a dinner/concert at Rubens' house. . . . Well, that's all for this month, more news after the reunion.—Gail and Mike Marcus, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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Please send news for this column to: Eugene F. Mallove, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Please send news for this column to: Greg and Karen Arenson, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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It is my sad duty to report the death of John K. "Jay" Wooten III. Jay is survived by his wife, Martha, and his children, Jack and Amanda, and numerous other relatives and friends. He received a master's from the University of New Mexico while at Los Alamos National Laboratory. He received the lab's Distinguished Performance Award for preparing the software that eventually provided data displays during rocket flight after a launch from White Sand's Missile Range in 1989. His two greatest pleasures were hiking and golf, which he enjoyed until he became ill with multiple sclerosis.

Andrea Sanders writes: "After receiving an MA and PhD in chemistry from Boston University, I joined Shell Development Co. in Houston, Tex. An MBA and an interest in management lead me to my current position as VP for R&D at Findley Adhesives, the largest privately held manufacturer of industrial adhesives in the world. So now I'm in the land of cheese and beer (Milwaukee, Wis.) and would enjoy hearing from alumni/ae in the area."

Bruce E. Varnum writes: "Tamara and I have been married four years. We have a new baby, Kenneth Ballard Varnum. I'm a cardiologist at the Texas Heart Institute in Houston,

Tex., in practice since 1993." . . . Jim Manioia was appointed VP for academic affairs at Houghton College, Houghton, N.Y., leaving the world of sun and fun of Santa Barbara for the real world. His son, Jim IV, is graduating from CATE School in Carpinteria and is headed for a year of work in Africa before college. . . . Please send me your news.—R. Hal Moorman, secretary, P.O. Box 1808, Brenham, TX 77834-1808

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Please send news for this column to: Dick Fletcher, co-secretary, 135 West St., Braintree, MA 02184

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A card arrived from Lewis Held, anticipating our 20th Reunion. Tom Campbell is in a nephrology practice at the Marshfield Clinic in Marshfield, Wisc., where wife, Rebecca (Smith '73), is a pediatric neurologist. They are proud of their four children—all girls.

Our fabulous reunion will have been completed when this is read, and I will not have been there, as I am busy practicing writing in the future perfect tense. All is peaceful otherwise; the stars are out, the family is fine, the mountains are visible, and the quartet still sounds great. Write!—Robert M.O. Sutton, Sr., secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

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20th Reunion

Please send news for this column to: Dave Withee, secretary, 1202 Linden Dr., Mt. Pleasant, IA 52641

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Did you fear you would never see a Class of '75 Notes column again? Massive apologies for missing my last several columns. One time there was no news at all. The other times, I was the culprit—my workload was simply out of control over the past few months. Consequently, we have a lot of catching up to do.

Walter P. Lapatovich was awarded the 1991 Leslie H. Warner Technical Achievement Award, GTE's highest technical award, for work on high-frequency excitation of plasmas. He received the award in May 1992. . . . Michael Picheny is the manager of the Acoustic Processing group at IBM's T.J. Watson Research Center, where he works on speech recognition for computers. Michael lives in White Plains, N.Y., with his wife, Barbara Bolshon (Sloan '78), and two daughters, Lauren (10) and Alexandra (2). . . . Since April 1991, Brian G. Lustbader has been running his family's construction business, the P.J. Culin Construction Co., as executive VP and general counsel.

Kenneth S. Rumstay had the following to say, "The SARA (Southeastern Association for Research in Astronomy) project is proceeding. The new structure for the 0.9 m automated telescope is complete and installation of the instrument will occur in early 1993." . . . And this from Thomas F. McKim, "My wife, Jane, son Will, daughter

Polly, and I are all doing well. I have been involved for the past two months in a trial in Belleville, Ill.—with at least one more month to go. It has been an interesting experience complete with courtroom use of advanced (for lawyers) presentation technologies (such as laser discs to show video depositions). Technology continues to pervade the practice of law! But when will that robot do my work for me? . . . I am having déjà vu about my next item, so if this is a repeat, Harlan, forgive me. Harlan R. Davis wrote that his “last full time employer, Midway Airlines, crashed and burned just a year ago. As with nearly every pilot, finding a full-time position has been less than successful. Hopes are improving as 1993 approaches.” . . . Ira Benson is the senior data communications engineer with Rijnhaare Information Systems of Wayne, N.J. His company develops integrated software systems for the transportation industry, with a special emphasis on container shipping. The group he heads develops communications systems for our products. . . . Arlo Weltege works full-time on the faculty of the University of Texas Medical School and just started (as of November 1992) an emergency medicine residency. His wife started a full-time hematology-oncology practice last July. Their children, Frederick and Eleanor, are 4 and 1, respectively.

Elliot Feit and his wife, Claudine, had a daughter, Chava Simcha (Felice Eve) on April 29, 1992. Elliot still works at IBM in Poughkeepsie, N.Y., and is an adjunct professor at Marist College. . . . Jay Nadelson, his wife, Deborah Schreiber (PhD '83), and his son Scott (5) moved to Short Hills, N.J., after 12 years in New York City—“nice change of pace.” . . . Gray C. Safford writes, “our lives have moved up several notches in ‘busyness’ this year. My wife gave birth to our first child (a son, Daniel) in March ('92). Since July 1, 1992, I have split my time between Sparrow Point, Md., and Chesterton, Ind., where my company is commissioning two galvanizing lines for steel strip for Bethlehem Steel Corp.”

Michael Lebowitz had this to say, “My wife, Betsey Malcolm, and I have two great boys, Chris 2 1/2 and Brian, 10 months (as of December 1992). On the workfront, I am VP in Morgan Stanley's Fixed Income Research Group. . . . Yosuke Mishiro is into his ninth year of an assignment in New York, advising Mitsubishi and other Japanese companies for investments and divestitures in the United States. He can be contacted at MIC Consulting, (212)644-1845. . . . Sandra K. Fillebrown received tenure last spring in the Department of Mathematics and Computer Science at St. Joseph's University. Her two boys are now 5 and 7.

Peter Krag has joined Bechtel, in the Metals and Minerals Group, but regrets leaving Oregon. . . . Joseph D. Sacco is on the executive board administering a six-year national V.A. cooperative study, acronymed CHAMP. They are looking at methods to reduce mortality and vascular events after heart attacks—something exciting and different from day-to-day patient care and running the cardiology section at Albany Medical Center Hospital. Says Joe, “Hallelujah!”

After pledging “some moolah” to an alumni telethon, David Katz dropped the following line to me: “Karen has benefitted from the leveraged buyout boom of the '80s and was RIF'd from Trane last year. She has used her unemployment insurance to think about what she wants to do next and has started a graduate school program at Rider College in Tren-

ton to get her certification as a middle school social studies teacher. She is working part-time teaching computer skills to kids at day-care and afterschool centers through a program called Computer-Tots. [Our] kids are progressing through the schools quite well. Rob, who turned 11 in May, just had his first school dance and it was a sight. Rob was also the only fifth grader selected for the District Band. Dan is doing well and is looking forward to baseball season, when I coach his team. I still referee soccer and coach baseball when I'm not selling weather stations. Everyone asks me if the Clinton administration is helping our business. Unfortunately, we won't see any pickup until new regulations are passed, which always takes two to three years.”

And now I am into the land of the newsclips. The October 26, 1992, issue of the *Republican American* of Waterbury, Conn., informs us that David L. Olive, formerly an associate professor at Yale University School of Medicine, is now chief of reproductive endocrinology at Yale-New Haven Hospital in the Department of Obstetrics and Gynecology. . . . The January 18, 1993, *Wall Street Journal* reported that Eric R. Rosenfeld has resigned as co-director of The Fixed Income Group at Salomon Brothers in New York. . . . The December 14, 1992, *Tampa Tribune* reported Frederick Foreman was expected to become the first black engineer to earn a doctorate from Florida A&M.

I am pleased to report that the Class of 1975 scholarships for the 1992–3 academic year went to Claudia Abendroth of Chicago, Ill., and to Gail Denesvich of Drums, Pa. Claudia was a senior and received an SB in chemical engineering this year. Gail completed her sophomore year majoring in electrical engineering and computer science.

Finally, I am very sad to report that Judith A. Fairchild died on November 24, 1992, as a result of a horseback riding accident. Judy had been living in Sacramento, Calif., where she practiced medicine. Many of us will remember Judy as the chair of our 1975 Ring Committee who worked tirelessly to get us our brass rats.

That's all for now. Keep writing.—Jennifer Gordon, secretary, c/o Pennie & Edmonds, 1155 Avenue of the Americas, New York, NY 10036, or 18 Montgomery Pl., Brooklyn, NY 11215

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Please send news. Without it, we cannot have a column.

David Leighton writes: “We finalized the adoption of our twins on October 26, 1992. We now have four adopted children: Joshua, 8, Christopher, 7, Cassey and Corbin, both 4.” . . . From Peter Okin: “It's been a long time since I've written. I am still in New York City, married 16 years to Lisa DeAngelis (Wellesley '76), with two sons: Daniel, 8, and Stephen, 5. I am an associate professor in the Division of Cardiology at Cornell Medical College and Lisa is an associate professor of neurology at Memorial Sloan-Kettering Cancer Center.” . . . Todd Kushner writes: “My wife, Lea, and I proudly announce the birth of our son, Joshua Philip Kushner, on February 10, 1993. I am still employed by IBM in Gaithersburg, Md., (no small feat!) teaching software engineering to IBM and commercial students.”

As for your secretary, he remains very busy

with his various endeavors, and earnestly beseeches you all to send news. Write, phone, fax—any medium, but please send it.—Arthur J. Carp, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523; (516)295-3632; fax: (516)295-3230

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Dear friends, I have much news this month since I am making up for my absence in the last issue. We have had a very hectic spring, with a wonderful trip to Savannah for the children's first Passover seder, Kellen's First Communion, and putting our house on the market. I certainly hope that by the time you read this we will be in a new house! Look for my new address in an upcoming issue! . . . Word was received that Gregory C. Coutts received the Harold E. Lobdell '17 Distinguished Service Award. This award is given in recognition of valuable alumni relations service to the Alumni Association and/or the Institute that is of special depth over a sustained period.

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Jonathan Green sent me e-mail from MIT. He says, "After spending 10 years at MIT's Lincoln Laboratory, most recently doing research into the applications of superconductivity to analog signal processing, I decided that *real* contributions to the world could better be made from private industry. Therefore, to prepare myself for a future out in the real world, I enrolled in the Sloan School to get my fourth college degree, this time a master's degree in the Management of Technology. At the conclusion of the program in June [1993] I will be looking into joining a start-up (ad)venture. Any aspiring entrepreneurs should contact me at jgreen@sloan.mit.edu."

In January of this year, the board of directors of Booz-Allen & Hamilton elected Martin F. Michael as vice-president. Martin is an officer in Booz-Allen Health Care, Inc., and leads health-care consulting activities on the West Coast. . . Also in the VP business is Frederick L. Merrill, Jr., who is a vice-president with The Finch Group, Inc., a Boston-based, full-service real estate development and management firm. His responsibilities include oversight of all new development projects and asset management services for bank and financial institutions. . . Beth Ganister reports that Ganister Fields Architects is still doing well. They are doing master planning for the Girl Scouts in conjunction with two other female-owned firms creating lots of campsites! Her children are growing up fast; Lauren is now 6 and the twins, Julia and Jackson, turned 3 in January. She claims, "Life is hectic, loud, and never boring!"

I always appreciate your taking the time to include an update on your life/activities along with your Alumni/ae Fund contributions.

Rest assured that these reach me regularly and are currently the main source of my information about our classmates. For instance, Walter Goodwin used this method to let us know that after seven years of long hours in two different law firms—one in Omaha, the other in Columbus, Ohio—he declined a partnership opportunity and took a more sedate job as in-house counsel with Honda of America Mfg., Inc., in Marysville, Ohio. Since Marysville is 53 miles from his house in Reynoldsburg, he leases an apartment just 10 minutes from his job. He reports that he talks to Dr. Leigh Watlington on a rather frequent basis. She's still in D.C. practicing ob/gyn with an HMO and touring the Formula One circuit every year. Walter can be reached at (513)642-0069. . . Tom Coradetti sent a funny note from Roseville, Minn., along with his latest contribution to the Alumni/ae Fund. He writes, "After five years with NCR (cleverly disguised as a computer company), first in the cornfields (of Dayton, Ohio) then banishment to NCR Siberia (in St. Paul, Minn.), I have escaped the clutches of AT&T (cleverly disguised as a computer company) but not the climate of the land of 10,000 (frozen) lakes. I recently joined the infinitesimal Telecommunications Group of DigiBoard in its idealistic (and profitable?) effort to convert the industrialized world from smog-generating automobile commuters to politically correct ISDN telecommuters." Tom's e-mail address is tomc@digibd.com.

It is with great sadness that I report to you the death of our classmate, Franze T. Epps, Jr. Franze died July 3, 1992 in Boston. We extend our deepest sympathy to his family, most espe-

cially his parents in Houston. . . . On a more positive note, I am pleased to inform you of the current status of the Class of 1977 Scholarship Funds. Lawrence Lubowsky, one of the Class of '77 Scholars last year, has received his degree. Marcelo Chan continued as a Class of '77 Scholar for his senior year. Marcelo was a photographer for *The Tech* and played volleyball and hockey and compiled an excellent academic record. New this past year as a Class of '77 Scholar was Steven Jayne, a junior from Auburn, N.Y. Steven is an Earth and Planetary Sciences major and enjoys swimming and ice hockey. He is housemanager for Chi Phi and a member of the MIT Concert Choir.

I received a wonderful vacation postcard from Dan Nolet and his family from Disneyworld. I have unfortunately misplaced it in my frenetic attempt to get my house straightened up and presentable for sale. However I do remember Dan clearly identifying himself as a *Star Trek:TNG* fan. Thank you for the support, Dan. Now all you other trekkies as well as non-trekkies out there: don't forget your secretary's needy postcard collection on your next trip (to an exotic locale or the corner drugstore). Send notes, written or otherwise, to me, Ninamarie Maragioglio, secretary, for now still at 8459 Yellow Leaf Court, Springfield VA 22153-2522 or e-mail to hertz@xip.nrl.navy.mil

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Please send news for this column to: Jim Bidi-gare, secretary, 9095 North Street Rd., NW, Newark, OH 43055-9538, (614)745-2676

ProNet really paid off for me. Although I wasn't in the job market when I signed up, I explored an opportunity that was presented, and I ended up in a great new position. I can't think of any reason why someone wouldn't join ProNet.

Marc Jorrens '89

Whether or not you're currently looking for a job, people do make offers you can't refuse. The MIT ProNet service is designed to keep you abreast of challenging opportunities in a variety of fields, including: High-tech, Venture Capital, Fortune 500, Start-ups, Bio-tech, Aerospace, and many more.

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MIT ProNet . . . it works.

Lester Suna has a busy cardiology practice in Cincinnati, and is also kept busy by his two children, Michael and Elise. . . . Jude Shavlik is an assistant professor in the Computer Science Department at the University of Wisconsin. In June of last year, he married Zoann Branstine. . . . Arlyn Garcia-Perez was tenured at the National Institutes of Health in Bethesda, Md., last September. She is now a senior investigator at the Laboratory of Kidney and Electrolyte Metabolism of the National Heart, Lung, and Blood Institute of NIH.

Jim Lester is working with Roundtable Research, a consulting group of scientists, managers, and entrepreneurs involved in facilitating the commercialization of research. He remains a partner in the government contracts and technology law groups of Patton, Boggs & Blow in Greensboro, N.C. . . . Lisa Egbuonu-Davis has certainly accumulated credentials since her MIT days. She graduated from the Johns Hopkins School of Medicine in 1993 with an MD. She also received an MPH that year from the Johns Hopkins School of Hygiene and Public Health. She completed a pediatrics residency at Children's Hospital of Pennsylvania in 1986. In 1988, she did a Robert Wood Johnson Clinical Scholars Fellowship, and also received an MBA from my alma mater, the Wharton School. Married to Gary Davis in 1989, she has a 3-year-old daughter, Morgan Davis. Lisa lives in Indianapolis and is working in the pharmaceutical industry in marketing.

Panos Cavoulacos writes, "1992 was a momentous year for us. Our third child, Dimitri, was born in D.C. on March 10. After our seven years with McKinsey, including the last four in Paris, I decided to join GE Industrial and Power Systems as manager of business development. Moving to Albany from Paris was not easy on my wife, Alix, and our daughters, Alexandra and Sophie—especially in the snow! As for me, I've been traveling around the globe to help expand GE's leadership position and global reach." . . . Your faithful secretary is opening this weekend Off-Off-Broadway in Rodgers and Hart's *The Boys from Syracuse*. After that, looking forward to a restful summer.—Sharon Lowenheim, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

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Congratulations to Michael Gennert! Michael was granted tenure and promoted to associate professor of computer science at Worcester Polytechnic Institute. His research and teaching interests are in image processing, image understanding, artificial intelligence, and databases. . . . Congratulations also to Dr. Andrew Braunstein, who recently achieved board certification in general surgery and became a partner in the Florida Surgical Group in Orlando, Fla.

Robert Tait writes he is now director of marketing for Allco Chemical, a producer of monomers for high-temperature plastics. He and his wife, Kay, who works for Hoechst Celanese's Chemical Group, travel quite a bit, leaving little time to enjoy home life in Dallas. . . . Also moving up, Allan Weis is now president and CEO of Advanced Network and Services, Inc. ANS provides Internet services and other multiprotocol network-related services to Fortune 500 companies as well as to many

federal and state agencies, including the National Science Foundation. . . . After completing a PhD in agricultural economics at Berkeley, Katherine Ralston moved across the country to Washington, D.C., where she now works for the Economic Research Service of the U.S. Department of Agriculture, researching food safety issues.

I received a very nice letter from Lisa Mason. After getting her MA in biology at UCLA she went to med school across town at USC. Initially Lisa thought she wanted to be a surgeon and toiled two years in surgery residency in Oakland before realizing she wanted to be a "good ol' fashioned family doc." The next three years were spent in a family practice residency in Wichita Falls, Texas, where she met her husband, another family practitioner. The two of them moved to Modesto, Calif. Lisa enjoys working for a large multispecialty group, Gould Medical Group and is a member of the board of directors. The proud mom sent me a beautiful picture of her two daughters, Destie Jo (4) and Gina Gayl (2). Thanks for the letter!

Other proud parents are Jean Wisner Dupon and husband Ryan. They became first timers when Daniel was born in June, 1992. . . . Adra Smith Baca and husband Paul announced the arrival of Nicholas James on May 28, 1992. At one month Nicholas was already wearing a MIT sleeper in the picture they sent. Adra is still working at Sandia National Labs in Environmentally Conscious Manufacturing.

By the time that you read this Hillary (Lust) Canning, husband, Michael, and daughter, Caroline, should have an addition to the family. They live in Dade County, Fla., where they are still recovering from Hurricane Andrew. They all made it safely through the storm.

What did you do on your summer vacation? Send your news to: Kim Zaugg, secretary, 2384 Leslie Circle, Ann Arbor, MI 48105, (313) 665-2365, vayda@erim.org

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Please send news for this column to: Mike Gerardi, secretary, 21206 Glenmoor Dr., West Palm Beach, FL 33409; (407) 655-5050 (w), (407) 683-4003 (h)

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There is not much news to report. It would be great to hear from more of you. I love getting mail. Also, I just joined America OnLine. My id is PDALADY. Figure that one out!

Austin Puglisi will be getting an MD in May and in July will begin residency at the University of Arizona Medical Center in Tucson. . . . Dexter Charles was recently promoted to head U.S. Dollar Derivatives Group at the Chase Manhattan Bank. He and his wife, Lisa, are expecting a second child. Good luck. . . . Lloyd Bloom survived the World Trade Center blast and continued trading on the Futures Exchange for one hour after the blast. What's wrong with this picture? . . . Scott Hyman is assistant professor of physics at Sweet Briar College in Virginia. . . . Mark McQuain and his wife, Dee, now have three boys, Byron (6), Will (4), and Taylor (3). He recently accepted the position of associate medical director at Northeast Tennessee Rehabilitation Hospital, in addition to being in private practice in rehab medicine.

Our sympathy goes to Helene Kauder, who

lost her second child, 4-month-old Benjamin, to Sudden Infant Death Syndrome (SIDS).—Helen (Fray) Fanucci, secretary, 502 Valley Forge Way, Campbell, CA 95008

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Steven Janowsky writes that he is moving to Texas where he will join the Mathematics Department faculty at the University of Texas at Austin. . . . Adrian Yovanovich is working as a management consultant for Gemini Consulting in Boston. . . . Karin (Yura) Benack writes that she is working for DuPont in Atlanta, Ga. Karin's husband, Bill Benack, also class of '83, recently started his position as finance manager with Sprint in Atlanta. Karin and Bill have twin daughters, Caia and Brianne, who just turned 1 year old. . . . Billy R. Hughes writes that she now prefers to be called B.R. Hughes, ever since her recent acceptance of the chairmanship of a commodities trading firm.

Akwete Akoto is president of a growing/struggling mail order company, Prime Heritage Collection. The company imports Afro-centric products from Africa. Akwete started the business with brother, Yaw, '74. The company was recently featured in the January, 1993, issue of *Black Enterprise* magazine. . . . Michael McConnell writes that he is a first-year cardiology fellow at Brigham and Women's hospital in Boston. Michael married Lena Wu, whom he met at Stanford. Lena is doing a post-doc in genetics at Harvard Medical School. Michael and Lena are currently looking for a house and are also looking forward to our 10th Reunion. . . . Speaking of our reunion, this is the last column of my five-year term, and I'd like to thank Valerie Sullivan for her help with document preparation.

Please make sure to keep those cards and letters coming. Whoever is elected our next Class Secretary will be very appreciative.—Jonathan Rodham Goldstein, secretary, c/o TA Associates, 45 Milk St., Boston, MA 02109; fax (617) 574-6789

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10th Reunion

Pete Schunemann was named a winner of the Lockheed Sanders' Technical Achievement Award for his work in crystal physics. Pete has been with Sanders since 1987. . . . Hauke Kite-Powell is living in Falmouth with his wife, Soo Sheung Wong, and two wolves. Visitors are welcome but cautioned about just climbing over the fence.

Dave Walter has taught himself how to play the bass, formed a band (Red over White) with some of his co-workers, and by now has recorded a demo tape. Look out world, a materials scientist is on the loose in the music world. Dave is not planning on a career in music but it is a great diversion from being an engineer at Boeing. . . . Jeff Friedman has moved back from the left coast to Boston to begin pediatrics training at Children's Hospital after finishing an MD/PhD at Stanford. He is joined by his wife, who is in training in neurology and expecting their first child this fall. New house, new job, new kid, new car. . . .

Steve Baker, after working for the last nine years to finally become a principal in his architecture office last year, fell victim of the recession this past December. He is starting out on his own but it is pretty tough. Steve is in touch with his fraternity brothers, most of whom



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seem to be having babies. . . . **Duane Boning** and his wife, Peggy (née Norris, '85), had their second child last year. . . . **Richard Benfer** and his wife, Meredith, were expecting in July. Duane is now an assistant professor in EE at MIT and Rich has returned as a student in the Sloan School. Steve sees **Dave Zion**, **Ian Glasgow**, and **Dennis Dougherty**, '83.

John Einhorn writes that he and his wife, Lora Childers, have been married for about 2-1/2 exciting and busy years. John spent some time in 1991 continuing to fly F-14s for the Navy, including three months in the Persian Gulf and more than 40 sorties in support of Desert Storm and Provide Comfort (helping the Kurds in northern Iraq). John then moved from Virginia Beach to Maryland for a year at the Navy Test Pilot School. After that he and his wife were off to California, where John is testing out the F-14D.

Steve Altes is traveling between Washington, D.C., and Moscow as a consultant to the Russian Government on privatizing Soviet enterprises. Prior to this, Steve was the director of business development for Aurora Flight Sciences and served on the Clinton-Gore transition team. Previous to that, at Orbital Sciences, he worked on *Pegasus*, the world's first privately developed space launch vehicle, and was a co-recipient of the National Medal of Technology presented by President Bush. Steve's wife, Barbara, spent 1992 traveling with the Clinton-Gore campaign and now works in the White House Office of Science and Technology Policy.—**Howard Reubenstein**, secretary, 28 Mitchell Grant Way, Bedford, MA 01730, 617-275-0213 (home), hbr@mitre.org

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Howdy gang. And now for the news.

TUTE TOOL TERRORIZES TOKYO—**Alec Atkin** is terrorizing the people of Tokyo with the Harley Davidson that he bought in California and shipped to Japan. He is also a menace on ice thanks to the hockey club he joined. In his spare time Alec works for Hayes Wheels International, which makes aluminum wheels in the United States and sells them to the Japanese as well as to the Big Three in the U.S. Alec reports seeing **Celia Lee** in Honolulu in December while she visited her family.

PRODIGAL SON RETURNS TO MIT—**Greg Fu** is returning to MIT as an assistant professor of chemistry after a post-doctoral stint at Cal-Tech. . . . **CLASS SECRETARY BLASTED**—Yours truly received a scolding from **Gaile Gordon** for spelling her name without an "e" and saying that she worked for MITRE when she really works for TASC. (Actually she was very nice.)

LANGUISHING LETTER—A letter from **Inho Kim**, forwarded to me in Japan, lay in unpacked baggage until now. Inho writes that after graduating from MIT he picked up an MS and an MBA. He did a stint at IBM before becoming self-employed. Inho recently joined a fiber-optic company called Fibersense and Signals as an operating partner in Toronto, Canada. He enjoys living in the Great White North. He and his wife, Jackie, have been going to weddings, the latest from Class of '85 being that of **Ken Katz** in Chicago.

SACHA SURFACES IN SPAIN—**Dennis Sacha** recently received the Navy Achievement Medal for superior performance while serving with Fleet Air Reconnaissance Squadron Two, Naval Station, Rota, Spain, where he is currently stationed. . . . **COHEN'S CAREER CLIMBS HIGH**—**Adam Cohen** is the vice-president of

R&D for Soligen, Inc., which is commercializing MIT-invented technology known as "three-dimensional printing." Soligen manufactures machines that automatically fabricate ceramic molds for metal casting directly from a computerized design. Several machines have been installed for customers in first quarter '93.

CANADIAN TAKES FORD PLASTICS AND ANN ARBOR BY STORM—In 1991, **Steve Meszaros** moved from Sandusky, Ohio, to Ann Arbor, Mich., where he spent the last two years as product line manager responsible for air induction and evaporative emissions components in Ford's Plastics and Trim Division. Now he is a product engineering supervisor responsible for the design of exterior lighting products. Steve is Ford's ace MIT graduate recruiter for the plastics division—15 and counting.

VIP AT VPI—**Faruk Bursal** is now an assistant professor of mechanical engineering at Virginia Polytechnic Institute in Blacksburg, Va., where he recently hosted yours truly during a conference there. Last December Faruk attended the wedding of **Leslyn Thompson** and **Serdar Boztas**, '83, in Barbados. **Eric Reiner**, '83, did one of the poetry readings, and **Tanju Cataltepe**, '82, also participated in the wonderful time had by all.

RANDOM ODDS AND ENDS—**Erik Devereux** has just finished his second year in the H. John Heinz III School of Public Policy at Carnegie Mellon University. The school was recently renamed after the popular senator who was killed in an air accident two years ago. Random Hall compatriots **Joe Kilian** and **Ondria Wassem** visited Erik. By sheer chance Joe and his wife and Ondria and her husband live very close to each other in New Jersey. (It took a while for me to get that joke.) . . . Speaking of Random, randomly selected **Thuan Tran** is living in Cambridge, Mass., with **Hai Vo**. Thuan works for Zylogix in Burlington, Mass., while Hai works for Wellfleet Communications. Hai still hangs with the MIT Vietnamese Students Club and is considering a trip back to Vietnam next year.

Next month look for news from **Julie Forman-Kay**, **Jerald Menozzi**, and **Jean Moroney**.

Send news to **Bill "Scoop" Messner**, secretary, 5927 Alder Street, Pittsburgh, PA 15232. Internet: bmessner@andrew.cmu.edu; (412) 361-4180

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Sorry about missing last month's column. No excuse, I guess my article arrived late. I'll try to be more prompt.

Got a very nice letter from **Noel Zamot**. Noel passed on the exciting news that he was accepted to Test Pilot School. He'll report to Edwards Air Force Base (one of the few still open) in mid-July and be stuck,oops I mean, stay there for the next five years. (At least it's close to L.A.). His wife will probably be flying NKC-135s there so they'll get to stay together (and maybe start a family). Of course, the school has been likened to redoing Unified in five months but Noel's still really psyched. Noel passed on some news about other Air Force flyers: **Jim Wilkerson** is out at Castle AFB, Calif., upgrading to aircraft commander. Jim's pretty happy and will probably stay there awhile with his two dogs (and maybe a snowmobile for next winter). . . . **Rich Maurer** will be heading to Grand Forks, N.D., (where Noel is leaving from) after he finished B-1 (Bone) school at Dyess AFB, Tex. Of course,

he'll arrive just in time to move to Ellsworth AFB, S.D., since they're realigning everything. At least he'll make a lot of money on moving expenses.

Paul DiMilla is currently finishing up a two-year post-doc in chemistry at Harvard. He is very excited about starting in June as assistant professor in chemical engineering at Carnegie Mellon in Pittsburgh. . . . **Leon Liem** is a resident in neurosurgery at the University of Maryland in Baltimore. . . . **Jim Nugent** recently moved to Hanscom AFB, Mass., after he received an MBA from UCLA (June 1992). Son Conor turned 1 in November (we still think Doppler Gauss was a cool name for Jim's kid). . . . **Michael Diener** is now an associate at Wolf Greenfield & Sacks in Boston, Mass. He was formerly an attorney for Fish & Richardson, also in Boston.

James Pinkerton is going to the University of New Mexico for a master's in computer science. He's working at the robotics center at Sandia National Labs. He has a new German Shepherd pup named Chaco. . . . **Bob Rozier** is a systems analyst for TRW Environmental Safety Systems, the management and operating contractor for the Department of Energy's high-level radioactive waste management program. He recently completed a preliminary feasibility assessment of using multi-purpose canisters for the storage, transportation, and geologic disposal of spent fuel from all of America's nuclear power reactors. Others on the task force included William Hollaway (PhD '91), James Clark (SM '65), and N. Barrie McLeod (PhD '62).

Scott Berkenblit spent a week in Iceland with the MIT Concert Band in January 1993. They worked their way from Akureyri in the north to Reykjavik in the southwest, with a concert each night in a different town. He got to visit the Nordic House in Reykjavik, designed by Alvar Aalto (same guy who designed Baker House). The tour was a tribute to John Corley, who has conducted the band since 1948 and who began his career 50 years ago with the U.S. Army band in Iceland. **Tim Shepard** and **Ed Ajhar** also went on the tour. . . . **Chris Da Cunha** finally checks in with us since graduation. He worked in Boston for two years doing consulting/venture capital. Then he attended Stanford Business School for an MBA and has been at Alex, Brown & Stone since doing investment banking. Chris lives in San Francisco and recently became engaged to Mary Jane Weaver—the highlight of his past 11 years in the United States. He still tries to visit Kenya whenever he can.

Lieutenant Renton Carsley is currently with fighter squadron-32, Naval Air Station Oceana in Virginia Beach, Va. He is finishing up a six-month deployment to the Mediterranean, Adriatic, and Red Seas as part of the aircraft carrier USS *John F. Kennedy* battle group. Elements of the battle group are supporting Operation Provide Promise in support of UN sanctions against Iraq and Yugoslavia. Renton has visited ports in Naples and Trieste, Italy, and Marseilles, France. . . . **Maya Paczusi** was among 12 award winners announced by the Department of Energy Office of Science and Education to a new postdoctoral research program. The appointment will be served for three years at participating DOE facilities around the country. Maya will be hosted by the Brookhaven National Lab where her research will focus on the critical properties and surface ordering effects in holmium.

Ray Schmitt and **Karen (Wohl) Schmitt** came to visit us during the spring. They dragged us out to Old Town Alexandria for

some great Thai/Chinese food. It was also a nice chance to see Marty and John Jennings, '84 and Joe Parrish. Marty is a pediatrician working in the District while John is working for ARPA (Advanced Research Projects Agency—used to be DARPA) trying to convert a lot of technology from defense use to private industry. Joe is still hanging in there with NASA and the space station. We wish him lots of luck.

I have some big news to pass on as well. We took the big step and bought a dog, a Samoyed to be exact. Yuri is about 3 months old at the time of this writing and acts just like a little kid. This is providing us with good training because we're also expecting a new addition to the family in November. (Can you see me pregnant? Boy, people will do anything for love!) Please write.—**Mary C. Engebret**, secretary, 21305 Arrowhead Court, Ashburn, VA 22011, (703)729-6568

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Hey guys. . . . Hope that everyone is having a great summer! **Becky (Edmiston) Lewis** writes that she married **Rich Lewis** (the same guy that she dated all through school) in 1990. After lots of travel in the past five years (Iceland, Maine, Spain, Portugal), she's back in the States, working in the Pentagon, and by now has had her first child (around Easter). In Spain, Becky saw **Denise Sacha** and her husband, **Dennis**, as well as **Mike Dennis**, **Mark Bader**, '85, and **Tom Boucher**, '85.

"My wife, **Alexis**, and I bought a house in Milton, Mass., last October," reports **Stephen Murphy**, "and keeping with the tradition we immediately gutted the kitchen. The new one should be on-line soon. I was promoted to manager of Emerging Technologies at the Haemonetics Corp. in Braintree, Mass. We make and sell blood-separation devices worldwide. Alexis is out of the day-care business, and recently started a consignment shop with a friend in Providence, R.I."

Classmates who are back in school include **Pierre Yanney**, who left AT&T Bell Labs last year. He is currently working at the New York patent law firm of Darby and Darby while finishing up law school at Rutgers University. . . . **Sharlene Liu** went to Switzerland for a year after getting a master's degree in EE from MIT. She's now back working on a PhD in speech recognition and says that she is having fun living the student life. . . . **Sameer K. Gandhi** is currently a first-year MBA student at the Stanford University Graduate School of Business. Also at the B-school there are **Tim Mattox**, '88, and **Craig Cohen**, '89. . . . **I-Chun Lin** will start a PhD this fall at Stanford, where her proposed fields of work are inequality, social stratification, and class mobility. Since graduating from MIT, I-Chun has been working in the telecommunications industry and taking sociology courses at UC/Berkeley.

Briefly. . . . **Michael Donohue** writes that he is excited about his new career as a high school mathematics teacher. . . . **Philip Sanchez**, an assistant actuary with Columbian Mutual Life Insurance Co. in Binghamton, N.Y., has been named an associate of the American Society of Actuaries. . . . Navy Lieutenant **Peter Donis-Forster** recently graduated from the Engineering Duty Officer Course on Mare Island, Vallejo, Calif.

Finally. . . . You can now fax your news to me on the new Class of '87 FaxTips Hot Line, at (512)472-7546. (Please use it—I justified

the purchase of the fax machine to myself by saying that I needed it for this column. . . . Don't prove me wrong!) Of course, you can still also write, call, or e-mail.—**Jack Leifer**, secretary, 2703 Swisher Street # 202, Austin, TX 78705; phone: (512)472-7507; fax: (512)472-7546; e-mail: leifer@ccwf.cc.utexas.edu

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Lisa Martin, class president, sent the following report: "Our 5th Reunion was a huge success! It was great to see so many of you and catch up on the last five years. Our reunion gift fund-raising effort ended the year with a bang. We were able to substantially increase our Class of '88 Scholarship Fund and present MIT with a gift that represented the strength of our continued support."

The reunion couldn't have been so successful without the dedication, creativity, and hard work of the committees and chairs involved. I'd like to thank and acknowledge all of those contributions: **Jocelyn Koehler** and **Sheila Neville**, reunion co-chairs; **Christine Chu**, reunion gift chair; **Jim Casamento**, nominations chair; and **Abdon Ruiz**, reunion treasurer. Reunion committee members: **Sharon Els**, **Erik Heels**, **Suzanne Maggioni**, **Abdon Ruiz**, **Kimber Lynn Drake**, **Carla Kapikian**, **Lon Sunshine**, **Reggie Tucker**, **Cathy Singer**, **Mike Donohoe** and **Jim Casamento**. Reunion gift committee members: **Doug Clevenger**, **Mike Couris**, **Diane Duckworth**, **Tracy Gabridge**, **Craig Jungwirth**, **Debbie Lee**, **Martha Lyman**, **Kelly O'Neill**, **Anthony Owens**, **Gary Webster**, **Earl Yen**, **Ken Yu** and **Kimber Lynn Drake**.

"I'd also like to thank our class officers for their efforts both in planning the reunion and in supporting class activities for the past five years: **Tracy Gabridge**, vice-president; **Grace Ma**, secretary; **Linda Chang**, treasurer; **Debbie Lee**, class agent; and **Kimber Lynn Drake**, class member-at-large. Finally, I'd like once again to thank **Jun Sochi** for the design of our class T-shirt which made a repeat performance at Alumni/ae Weekend. All your enormous show of class spirit and dedication made our reunion a success!"

Now onto the news. I hope everyone's summer has been fun! **Bradford Fenton** and his wife had their first child, **Victoria**, last spring. Congratulations!

Christine McIntyre writes from Chicago. She is enjoying pediatric residency there. Occasionally she runs into **Jane Ko** who is at the University of Chicago. . . . **Aimee Burstein** will be starting a clinical psychology doctoral program at Adelphi University in the fall. She spent the summer enjoying the beaches of Long Island.

Craig Cohen is currently enrolled at Stanford Business School with fellow TDCer **Jim Bevilacqua** and MIT classmates **Tim Mattox** and **Ariel Poler**. There are about 11 MIT alumni/ae total in the first year class out of about 365 students. Craig says, "There's way too many Harvard and Yale folks in our class though!" he also runs into fellow TDCer **Greg Belaus** who celebrated his five years at Adobe Systems by taking a month-long trip to Australia!

Mark Filerman is working at HP Medical Products Group designing ultrasound imaging equipment for echocardiography. He is engaged to be married in June '94 to **Judy Shen** (Harvard, '88). Congratulations! . . . **Paul Paternoster** resigned from Digital Equipment Corp. to take a job with Amdahl in Cali-

fornia. He is very excited about "starting a new chapter in his life." His wife, Kim, got a BS in computer science and hopes to find a job in Silicon Valley. . . . **Matt Kelley** received an SM in 1990 and joined a start-up software company which is "doing better than ever after three years." The company is based in Framingham, Mass., but Matthew enjoys living in Boston's South End. He will be married in October, although he doesn't reveal the name of his wife-to-be. Congratulations to you both!

Leslie Melcer has had an exciting five years. She spent two years in Santa Barbara getting a master's in electrical engineering, followed by a summer in Japan researching and drinking beer. She then worked for a laser company in Palo Alto for two years, but has recently returned to the "scenic, sunny (NOT!) Cambridge." She is engaged to Joe Bondaryk, '87. Yet another congratulations is in order.

Well, this could very well be the next to my last column ever for *Technology Review*. My life has not been nearly as exotic as many of yours, but I have enjoyed living vicariously through your adventures. Thanks for all your letters throughout the years, for if it weren't for them, we'd have no column. I'm winding up my internship at NYU, and I think I'm about ready to move on. I had a month off in April which I spent in Utah (skiing), L.A., Taiwan, Hong Kong, and Hawaii. Now I'm living for my next vacation!—**Grace Ma**, secretary, 19 Candlewood Rd., Lynnfield, MA 01940

89 5th Reunion

Here are this month's list of people to please write in: **Karl Dishaw**, **Monique Harold**, **Cheryl McCullum Smith**, **Carlos Sosa**, **Howard Zolla**. What are y'all up to? If anyone knows about any of these people or anyone else, please write in!

First, as promised, some reunion news. **Nancy Gilman** has agreed to be the reunion gift chair. Nancy served on our Senior Class Gift Committee as a gift solicitor and, since graduation, has served as an associate agent. Currently she heads up the MIT Club of Virginia. Nancy is excited about this position, and it looks like she'll do a great job. Some other members of the reunion committee have also had a kickoff meeting with the Alumni/ae Association staff, so things are starting to roll.

We still haven't gotten any picture submissions for the class calendar yet, so please send those pics in! There is also a new submission format—videotape (either VHS or 8 mm). All submissions will be returned. If no submissions come in soon, we'll postpone publishing it until just after the class reunion.

Anyway, on with the news! **Mike Malak** dropped me a brief e-mail note to say that he got a good shave yesterday. Mike's e-mail came by way of Caltech. . . . **Eric Sadler** is employed by the U.S. Army Environmental Hygiene Agency, and he is working on projects in Air Pollution/Environmental Engineering. . . . **Matthew McCarty** is still at Grumman Aerospace, which is generously financing his master's degree work at Columbia. Matthew is also active in the AIAA Long Island Section.

Gautam Gidwani is launching a Money Management Expert System Environment for trading and building trading systems for the futures, options, stocks, and hybrid markets. .

. . . **John Weeman** and his wife, Abby, are planning to ride their tandem across the United States this summer. John will be attending graduate school in the fall. . . . **Steve Betz** is experiencing a personal renaissance through drawing, painting, and photography. Steve plans to study both art and engineering as it applies to consumer product development at Stanford this fall. He has been designing cordless drills at SKIL Corp. in Chicago for the last two years.

John Allen recently marked his first year of work at 3M in St. Paul, Minn. John is enjoying both the job and Minnesota very much. He writes that he "spent a week in San Francisco attending a fuzzy logic conference with Yvonne Grierson, '90; we later got fuzzy ourselves during a day of wine tasting in Napa Valley." John and his fiancée, Sharon, recently bought a house; they plan to wed in August. . . . **Matt Junker** completed a five-month cruise of the Mediterranean aboard the USS *Woodrow Wilson*.

Timothy Collins is working for a management consulting firm named Symmetrix, along with Matt Katz, '90, David Oarkes, '88, and Patrick Donovan, '91. Timothy is coordinating a fund-raising campaign for the Delta Tau Delta fraternity and is on MIT's steering committee for the IRDF capital campaign. He also just bought a house in Milton, and is renovating it in his spare time. Timothy went to Mardi Gras with 15 other Deltas, and then spent July 4th '92 in Minnesota visiting Fred Schulz, Mike Murray, '90, and Matt Hockett, '92. Scott "Scooter" Hockett says hello from a submarine in Pearl Harbor, and Tim says that after two years in Hawaii, Scooter still has no tan! . . . **Brad Volin** and **Jamie Goldstein** are both at Harvard Business School.

M. Beth Shaw has been awarded a Robert Bosch Foundation Fellowship. The nine-

month program includes high-level, full-time work experience in the public and private sectors in Germany. M. Beth is one of 15 Bosch Fellows this year. . . . **Darian Hendricks** is working at Lotus, and is active in the Lotus Black History Month Committee.

Dave (Duis) Story was married July 25, 1992 with several MIT alums present, including but not limited to Roger Chen, '90, and Ali Alavizadeh, '91. Dave is working for SGI, and his products are now contributing well over \$4,000,000 yearly revenue for the company. He is working on printing and scanning software, and his group has now grown to five people. Dave has also been doing a lot of scuba diving. His wife, Christy, is in grad school, finishing a master's degree before she starts the PhD thesis search. Dave and Christy bought a house in Sunnyvale, Calif., and spent two solid months fixing it up. "We ripped out the old ceilings, painted everything (I mean EVERYthing!), new hinges on every closet and cabinet in the house, new linoleum, new baseboards, new carpets, new locks, fixed old toilets and sinks and showers, you name it. Now I'm so sick of it I haven't done any improvements except towel bars in two months!" Dave also bought a 14-foot Zodiac inflatable outboard boat last summer and works so hard at work that he can take every other Wednesday off to go diving.

Teri Centner is now working at McClellan AFB, Calif., in the Air Force Advanced Composites Program Office. There are three other MIT alumni/ae in her office—**Allegra Hakim**, '82, **Jocelyn Patterson**, '84, and **Jeff Farmer**, SM '93 (XVI). Teri is also now shooting expert in the 9mm handgun category.

In the only snail mail I received, **Rick Franklin** wrote to say that he was recently engaged to **Cindy Shen**, '90. Rick and Cindy are planning a May '94 wedding, after Cindy



A beaver cake was the eye-catching centerpiece at the wedding of Karlin Anderson, '91, and Sean McIntyre, '89, over Thanksgiving weekend in Yorktown, Va.. From left: Hideki Masaki, '89, Dawn Jegley, '83, John Travis, '90, Noel Chiappa, Gina and Robert Jarvis, '89, Heidi Miracle, '91, and fiancé Dan McMahl, Dean Miller, '91 (behind bride), the wedding couple, Jae Cho, '90, Aimee Quijano, '91, Mark Enstrom, '93, Sandra Chang, Leora Goren, '91, and David Whitney, '90.



graduates from the University of Maryland Medical School. She is finishing her third-year rotation in pediatrics and she loves the kids, Rick reports. He is flying C-141s for the Air Force, and he also loves his job. In the past year, he has visited over 20 countries on 5 different continents. "Christmas in Somalia wasn't fun, but February in Australia was awesome!" Rick writes. Cindy and Rick also did some traveling to Salt Lake City to attend the wedding of BJ Bergevin and Debbie Olney in late March. Rick, Richard Elder, and Kai-Yee Ho were groomsmen. Also in attendance were Sophia Wang, Stacey Rogers, Chris Doerr, Ken Dinndorf (Tufts/AFROTC '91), and Alexandra Leonetti, '92. "BJ was an excellent host and all smiles on the big day—I've never seen him happier."

After the wedding, Rick and Cindy traveled on to California to visit Joanne Spetz, '90, and Zain Saidin, '90, who got engaged while they were visiting, and are planning a November wedding. Rick and Cindy also spent an evening with Terry Fong, '88 and Jessica Hirschfelder, who are also engaged and planning a November wedding. They then stopped by Palo Alto to visit with Rick Wesel, '88, who is in pursuit of a PhD at Stanford. Before leaving, Rick and Cindy gathered with Joanne and Zain, Sophia and her boyfriend Nick, Alexandra and her sister Francesca, and Beth Fellingham and her mom. Beth's new company is doing very well, and Beth just bought a condo in California.

Mike Geer is still in grad school at MIT, and hopes to finish during the summer of '94. Mike is also the floor tutor for the Burton Third Bombers, "which makes life interesting." Also at MIT are Jim Koonmen, and Ken Dinndorf, among others. . . . George Rinaldi is in law school at the University of Pittsburgh and Nick Bateman is a grad student in physics at Yale.

Julie Shreeve is currently working on her last year or so of a PhD in inorganic chemistry at the University of California/Irvine. "Things are going well with my research, in fact, this summer I will be at Du Pont, in Wilmington Del., for 10 weeks, working on a collaborative project." Julie also writes that she is "getting married to Roy Keyer in October. He is also a chemist (not from MIT) and was in my research group here at UCI. He has graduated and is doing a post-doc at the Naval Research Labs in Washington, D.C."

Julie saw Julia Putnam last fall. Julia is doing well, and was just married at the end of April. Julie received a nice note from Eileen Sheu. Eileen is doing well in graduate school at Northwestern. She wrote that Rachel Duncan and Lora Danley are also doing well in their graduate programs. Rachel is at UC/San Diego, and Lora is moving back to Boston. . . . Maria Liebermann and Seth Brown, '88, are married. Both are at the University of Washington in chemistry.

Catherine Rocchio writes that she saw some classmates on Patriot's Day—"what a gorgeous spring day in Boston—believe it or not!!" Anthony Lombardo and his wife, Kristy, were up visiting Peter Neirinx and Rob Scalea, '77. (Rob was Anthony's Alumni Connection—what a great program!!) Peter recently got engaged to Kate Farrington in Paris!! They took a spur of the moment trip to the "city of love" and he proposed to her on an island in the middle of the Seine. They are planning an autumn '93 wedding." Catherine and everybody all got together for dinner at Legal Seafood and

compared notes on their lives. Anthony is still working on an MD/PhD at the University of Alabama in Birmingham. Anthony and Kristy recently took the plunge and bought a house right near the Med School. Peter is working at Draper Labs, playing water polo, and just moved from Beacon Hill to Charlestown. They all had just come back from a weekend trip to Maine where they visited with John Thomas, his wife, Sally, and their new baby boy, William Kendric. Maya Bose is still out in Chicago finishing up at chiropractic school. She should be graduating in December and plans to come back to the Boston area to associate with a doctor in Wellesley. Catherine is still working at BBN, coaching MIT gymnastics, and is enjoying married life!

Mark Kantrowitz has penned a book, *The Prentice Hall Guide to Scholarships and Fellowships for Math and Science Students, A Resource for Students Pursuing Careers in Mathematics, Science, and Engineering*. Mark is currently pursuing a PhD in computer science at Carnegie Mellon University on a National Science Foundation Graduate Fellowship and a Hertz Foundation Research Fellowship Grant. The book is co-written by Joann P. DiGennaro, who is president of the Center for Excellence in Education, a non-profit foundation dedicated to improving science and mathematics education. Michael C. Behnke offers this testimonial: "This book delivers more than the title suggests. Not only is this an excellent resource guide to scholarships and fellowships, it also gives a clear and concise description of admissions and financial aid. Students and parents should find this book invaluable."

Kevin Maguire (one of the designated respondees a few months ago!) is working at JPL as a guidance and controls analyst for the *Galileo* spacecraft. Kevin has been at JPL since leaving MIT in September '91, and is living with Alan DiCicco in downtown Pasadena. Kevin is also playing rugby for the Eagle Rock Athletic Club, where he is captain of the second sevens team and was voted MVP of the second side at this year's awards banquet.

Well, that's it for this month. Thanks again to everyone who wrote in, especially the "designated respondees!"—Henry Houh, secretary, 4 Ames St., Cambridge, MA 02142; phone: (617)225-6680; fax: (617)253-2673; e-mail: tripleh@athena.mit.edu or henry_houh@mit.edu

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Elena J. Koutras has just received the 1993 Award for Outstanding Service from the Virginia Society of Professional Engineers. She is being honored for her work with the National Engineering Design Challenge and the Junior Engineering Technical Society. Elena is also being recognized at her workplace, the Harris Group, for organizing their Christmas charity program as well as their quarterly clothing drives. Congratulations! Now, Elena is getting ready to move to Dallas, where she will be working temporarily for Knowledge Data Systems. In the fall, she will be studying on scholarship for her MBA at Southern Methodist University.

Chris Fennema and her husband, Randy Notestine, '89, have just bought a three-bedroom house in sunny San Diego! Chris is still busy working on a PhD at UC/SD. . . . Congratulations to Anne-Marie Conran and Mike Malak, '89. They are engaged and are plan-

ning a September wedding. . . . Priti Paul is now the overseas director of Apeejay-Surrendra Group in London. She is also working on her diploma (Part II) at the Architectural Association School of Architecture, London. . . . Janet Fordunski writes that she's now working in Irvine, Calif., as an engineer for a geotechnical consulting firm when she's not jumping out of airplanes!

Heidi Burgiel is in graduate school at the University of Washington in the Department of Mathematics. She's currently looking for a thesis topic in geometry and trying to devise a winning strategy for the computer in *Tetris*. Heidi is sharing a place with Seth Brown, '89, and Marya Lieberman, '89, who were married last June. . . . Mark Henault is working for Ford Motor Co.'s Plastics and Trim Division in Dearborn, Mich. He's been spending his free time skiing, biking, and helping to organize the Ford Hybrid-Electric Vehicle (HEV) Challenge. Thirty schools will be arriving to compete June 1-6 in the Challenge. Mark has also spent a fair amount of time back in Boston over the past two years recruiting new hires for Ford. . . . Denise Kato is now working in the Advanced Materials & Structures Group at Martin Marietta in Denver. She's waiting for people to visit her out there now that she's just bought a house in Littleton, Colo. . . . John Ambrose is in the Navy (Charleston, S.C.), on board the USS *Halyburton* as an ordnance officer. In March, John was married to Jill Wright, who is a medical student studying to specialize in pediatrics.

To keep these issues of *Tech Review* coming, don't forget to send in at least a \$25 donation to MIT! Hope everyone had a great summer! Please write in and tell us what's been happening—Ning Peng, secretary, 10140 Creekwood Circle, Plymouth, MI 48170 or ning@athena.mit.edu

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"Hello from New York!" writes Regina DeLorenzo. "After two years of getting experience in the field, I am finally on my way to veterinary school." In September, Regina will begin vet school at the University of Pennsylvania, and she says, "Any of my old pals from school should feel free to come visit!"

Kate Comer is working at Radian, an environmental consulting firm in Sacramento. "I passed through Boston in September on my way to an oil refinery in Pennsylvania," writes Kate, "and visited several classmates and souls not yet graduated. I won't be making any more refinery visits for a while—physical therapy from knee surgery takes too much time." In December, Kate spoke with Anne Bisagno, who was completing a chemical engineering master's at UC Santa Barbara. In February, Kate visited with Hope Menard, who is working for Exxon in New Jersey.

Alan Blount, John Orwant, and Nathan Abramson, G, are at MIT's Media Lab and have formed a band called "Psychic Hotline" with Steve Cooke and Jeanne Devaney (Wellesley, '93). "Psychic Hotline" performed at TT the Bear's Place during "Nerdapalooza" in April. . . . John Chen successfully passed a PhD qualifying exam in materials science at MIT and is working on his thesis. Dai Matsui, who is working in Japan, "visited John for a few days last summer. Last winter, John saw Dave Morrison, who is "doing well" at Oracle in San Francisco. "Also," writes John, "I would like to congratulate Se-wai Lee and

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Cynthia Tee for getting engaged."

I have a heaping plate of good news to share with you about our classmates in the armed services. Dutiful correspondent Alex Min writes that he will start advanced training for helicopters in the TH-57 Bell Ranger and should be "winged" as a Marine Corps aviator by the end of the year. He reports that Dave Haldeman was designated a naval flight officer in April and writes that unfortunately, "the Navy has no room for him on any plane, and Delta isn't hiring either!" Sunhi Yum is in Corpus Christi, Tex., training to be a Navy pilot. Alex writes that "she's about two months away from finishing up primary training and lives with two cats and a rascally rabbit." Alex also sends news that Laura Moore is the public affairs officer for the United States Naval Station at Panama Canal.

Jason Slibeck was married June 5th to Sara Queen (Wellesley '91) in Titusville, Fla. Sara works in New York City for Metropolitan Life's real estate investment division. Jason was on the USS Sumter, LST-1181, in the Adriatic Sea during the escalation of armed affairs in Bosnia-Herzegovina last spring. The USS Sumter is a tank-landing ship that was prepared to put an amphibious landing team of marines and seabees on the coast of the former Yugoslavia. During his six-month tour of duty, Jason also saw Spain, Turkey, and Israel. He now lives in Virginia Beach, Va.

And in other naval news, Bill Moliski graduated from the submarine officer basic course in Groton, Conn., in March. According to the Navy, Bill and his classmates learned about "the theory, construction, and operation of nuclear-powered submarines. They also receive instruction concerning damage control, submarine safety and escape procedures, and in submarine weapons, fire control, and sonar systems." Before even a month had passed, Bill was put to work again aboard the submarine USS San Juan, which is homeported in Groton. The Navy also sends news that Andrew McGuire reported for duty aboard the aircraft carrier USS Abraham Lincoln, homeported in Alameda, Calif., in April.

Andrei Saunders, Nancy Moorachian (Simmons, '93), and I recently spent a pleasant evening around Boston recalling the summers we spent in Washington, D.C., working for the Quality Education for Minorities Network with former Dean for Student Affairs Shirley McBay. Andrei is now working for Goldman Sachs in New York City.

Thank you for the news. I would love to hear about your summer vacations!—Andrew Strehle, secretary. Please send news to the appropriate address before August 31: 12 Commonwealth Court #10, Brighton, MA 02135, (617)232-2261; after September 1: 566 Commonwealth Ave., #406, Boston, MA 02215, (617)262-3495

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Wow! Can you believe that it's been more than a year since we've graduated? We've all had the chance to adjust to our lives as graduates, and many of us may be starting new adventures this fall. Our friends in graduate school are now looking forward to another year at the grindstone after hopefully having made the most of their summer. Mayumi Yoshinari is at Harvard University's GSAS studying developmental psychology. She says she had a hard year of studying while trying to look after three kids—6, 3 and 0 years. . . . Heather Weiss has been working for a year

now at Richard Dattner Architect, P.C., and has been accepted to the graduate architecture program at Berkeley. She's very excited and happy to be heading to the West Coast. . . . Jeff Scharf was married at the end of July to his high school sweetheart, Tracy. Congratulations to them and . . .

Congratulations to Sean Doherty who was married to Yan Sima in June in Houston. Sean, who incidentally graduated a year early, is working on a PhD in political science at Rice University. After graduation, Sean spent six months in Beijing studying Chinese culture. While over there he got in touch with Yan, whom he had met in Beijing during high school. Yan graduated this past year from Beijing Foreign Studies University with an English degree and plans to be a writer. . . . Gustavo Gutierrez used the same clever approach as Sean did to get news to me. They both actually called! Hail to modern technology! Too bad I don't have an e-mail account. Gus spent the first six months after graduation in Orlando, Fla., at Nuclear Power School along with Tim Salter and Kurt Steltenpohl. Gus was working 12-hour shifts at a Nuclear Propulsion Training Unit in Charleston, S.C. He says it was very intense. Kurt was in the same program out in Idaho and Tim in upstate New York. They were working on submarines or mock submarine layouts reproduced in buildings for those less fortunate. Gus is now in Groton, Conn., for four months of submarine school beginning in July.

Gus also tells me that Adam Leschner has been working for Solomon Brothers in New York and that Barrett Pappas is working in Puerto Rico for Ethicon, a subsidiary company of Johnson & Johnson. . . . Wen-Wen Chen is working full-time at D.C. Heath Publishing Co. in Lexington, Mass., publishers of educational textbooks. She is in a publishers' development program, which means she is moved from department to department so she will know how to run the whole operation herself. She's worked in science editorials, math editorials, art & design, and English so far. She is also doing some work for the journal *Assemblage* as well as taking a few classes. She took a book design class through her company and a British literature class at the Harvard Extension School.

Dan Green reports that his friend, Rob Bingel (Course X, ROTC), stationed by the Army in Fife, Wash., recently left for Somalia (mid-May to October), where he is managing the flow of arms. He would like to hear from classmates: 2d Lt. Rob Bingel, 63rd ORD Detachment, Unit 66, APO, AE 09896-0166, Somalia.

Eugenie Huang and Amy Lin were in Cologne, Germany, working for Eric Schneider-Wesling, Architect, beginning last August. Eugenie returned to the Cambridge area in April. Hoorah to both of them for finding a job in architecture as well as an adventure. *Guten arbeit!* . . . Gassia Salibian is in the graduate architecture program at Columbia University and still pulling all-nighters—my sympathy.

I bumped into Susan Serkes in the Denver airport in April while we were making our respective connections. She's been working for Price Waterhouse out in L.A. and was returning to Boston briefly to give her sister a bridal shower. . . . Jeff Kuehn moved out to Aspen to enjoy the mountain air for the summer. It was nice to see a familiar face in that small town for a season.

Remember: write to me—your secretary—Leslie Barnett, 56 Brown St., Mineola, NY 11501

I CIVIL AND ENVIRONMENTAL ENGINEERING

From Houston, Tex., **John R. Piatak, SM '91**, writes: "I am project engineer for M.W. Kellogg. I'm currently assigned to a 700,000 MTY MTBE/ETBE facility which will be built in Saudi Arabia starting in June '94. I am scheduled to go in-kingdom for 18 months to serve as liaison between Brown & Root Braun (project manager) and designer (M.W. Kellogg). The CCRE curriculum was 'dead on' target for me." ... **Francis J. Turpin, SM '57**, reports from Laurel, Md.: "I am director of International Harmonization in the National Highway Traffic Safety Administration, working on making motor vehicle safety regulations compatible on a worldwide basis. I represent the United States at the Working Party on Construction of Vehicles of the Economic Commission for Europe of the United Nations." ... **Captain Brian L. Baker, SM '92, SM '92 (XVII)**, sends word: "I am serving in Egypt with the U.S. Army Corps of Engineers as project engineer for \$40 million in construction projects for the Egyptian government." ... **Shafiqul Islam, ScD '91**, and **Michael Mandelbaum** are the editors of *Making Markets: Economic Transformation in Eastern Europe and the Post-Soviet States* (Council on Foreign Relations Press, 1993). The book culls assessments of four eminent economists who summarize the state of current thinking on the collapse of communism in Europe and the former Soviet Union. Islam is senior fellow for international economics and finance at the Council on Foreign Relations.

II MECHANICAL ENGINEERING

Robert Siegel, ScD '53, was selected to receive the American Institute of Aeronautics and Astronautics Thermophysics Award for 1993. The award is presented for an outstanding singular or sustained technical or scientific contribution by an individual in thermophysics, specifically as related to the study and application of the properties and mechanisms involved in thermal energy transfer and the study of environmental effects on such properties and mechanisms. The citation for Siegel's award reads for "outstanding contributions to thermophysics including boiling in low gravity, transient forced and free convection, solidifica-

tion, and thermal radiation." The award consists of an engraved bronze medal, certificate of citation, and a rosette pin. Siegel is a senior research scientist at NASA Lewis Research Center in Cleveland, Ohio. ... **M. Beth Shaw, '89, SM '90**, has been awarded a Robert Bosch Foundation Fellowship for 1993-94. The nine-month program includes high-level, full-time work experience in the public and private sectors in Germany. The program is very selective and available to only 15 American citizens each year. ... **Thong Phamduy, SM '88**, was recently profiled in the *Malden (Mass.) Observer*. The Malden High School teacher was recognized for his work in helping to teach math and culture to the 60 Vietnamese students in the bilingual program. In the article, Phamduy recalls leaving Saigon with his three younger sisters five years after the city fell to the North Vietnamese. He remembers the extra help teachers gave him as he learned English and wants to be able to help other Vietnamese students tackle the same hurdles. ... **Captain Gordon D. Marsh, SM '76, OCE '76 (XIII)**, was recently awarded the Coast Guard Humanitarian Service Medal while serving at Coast Guard Marine Safety Office in San Juan, Puerto Rico. According to a Coast Guard news release, he received the award for "extraordinary service during the period from October 1, 1991 through November 1992, during which the men and women of the Coast Guard undertook several massive operations that involved the entire service in selfless acts of humanitarian assistance far beyond the call of duty. During this time Marsh participated with other members of the Coast Guard in duties ranging from maritime search and rescue, and marine environmental protection, to national defense and law enforcement."

The Association of Alumni and Alumnae has been notified of the following deaths: **Douglas A. Elkins, SM '36**, of Salt Lake City, Utah, on April 3, 1993; and **Colonel Stanley W. Connelly, SM '40**, of Birmingham, Mich., on July 18, 1992. There was no further information provided.

III MATERIALS SCIENCE AND ENGINEERING

Richard C. Sussman, ScD '75, has been appointed general manager of Process & Stainless Steel Research at Armco Research in Middletown, Ohio. In this new position Sussman is



Richard Sussman

responsible for research activities in the areas of steelmaking, strip casting, welding, casting, rolling and heating, instrumentation, electro-optics, and stainless steel products. Sussman joined the company's Research Center in 1975. During his career, he has specialized in casting and steelmaking research.

John J. Burke, SM '56, MAE '57, PhD '68, of Chestnut Hill, Mass., died on April 5, 1993. In 1950, Burke began working at the Watertown Arsenal as a metallurgist, and for the next 30 years served at the Army's Materials and Mechanics Research Center in research, advisory, and administrative roles. For seven years prior to retiring in 1980, was associate director of the research center, supervising about 600 scientists, engineers, and support personnel. In 1980 Burke established John J. Burke & Associates, Inc., where he served as president. He was VP of R&D at Multi-Tech Corp. and a senior technical advisor of Charles River Associates, Inc. He developed the SPIDERchart (Systematic Planning for the Integration and Direction of Engineering and Research) management concept that is used by the U.S. Department of Defense and industry. A prolific writer, Burke was editor of the *Army Mantech Journal*. He was a member of the New York Academy of Science, the ASM, and American Men of Science. ... The Association of Alumni and Alumnae has been notified that **F. William Bloecher, SM '49**, of Wyckoff, N.J., died on February 28, 1993. There was no further information provided.

IV ARCHITECTURE

John P. Ruffing, MAR '61, writes: "I am architect/principal at Payette Associates, Inc., an architectural design and planning firm in Boston. I joined the firm in 1971. The latest significant projects for which I am the principal-in-charge, designer, and project architect, include the new (1989) Youville Hospital

DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering

ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering

MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science

patient wings on Cambridge Street in Cambridge, and a new (1993) 12-story, 285,000-square-foot biomedical research building at the School of Medicine at Case Western Reserve University in Cleveland, Ohio. Before attending MIT, CWRU was my undergraduate alma mater." . . . **Mark W. Vande**, MAR '70, is president of Vande Architects in Palmyra, N.Y. The firm is designing schools, special education/housing facilities, and medium-sized manufacturing plants. . . . **Keith M. Gilbert**, SM '90, has a new baby daughter, Sarah Osur Gilbert, born December 13, 1992. . . . **I. Donald Weston**, '50, principal of Martyn & Don Weston Architects in Brooklyn, N.Y., was recently named as a Fellow of the American Institute of Architects. The AIA citation reads, "His career stands as an example of an architect lending his talents toward making his profession of ever-increasing service to society."

V CHEMISTRY

Canfield Hadlock, PhD '33, of Kennett Square, Pa., died on February 11, 1993. He joined Du Pont Co. in Wilmington, Del., in 1935 and worked there for 35 years. During WWII he worked on the Manhattan Project with the Army Corps of Engineers while stationed in New York City and Oak Ridge, Tenn. He returned to Du Pont in Waynesboro, Va., and later relocated to Wilmington, where he was associated with the textile division.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Michael A. Gennert, '80, SM '80, ScD '87, has been granted tenure and promoted to associate professor of computer science at Worcester Polytechnic Institute. Before joining the WPI faculty in 1987 he was a senior analyst at PAR Technology in New Hartford, N.Y., adjunct professor at the State University College of Technology in Utica, N.Y., and a research assistant at MIT. Gennert's research and teaching interests are in image processing, image understanding, artificial intelligence, and databases. . . . *Things That Make Us Smart: Defending Human Attributes in the Age of the Machine* (Addison-Wesley, 1993) by **Donald A. Norman**, '57, has just been published. In the book, Norman offers an "examination of the complex interaction between the human mind and the 'tools for thought' it creates, arguing for the development of machines that fit our minds, rather than trying to tailor our minds to fit the machines," states the book jacket. Norman is an Apple Fellow, the highest level technical appointment at Apple. He is the author of *The Design of Everyday Things* and a recent book of essays, *Turn Signals Are the Facial Expressions of Automobiles*. . . . **Daniel Crevier**, SM '72, EE '73, PhD '74, is the author of *AI: The Tumultuous History of the Search for Artificial Intelligence* (Basic Books, 1993). The book is based upon a synthesis of extensive interviews Crevier held with 10 of the top names in the artificial intelligence industry, such as Marvin Minsky, Herbert Simon, and Allen Newell, among others. Part intellectual history, part business history, the book chronicles dramatic successes and failures and illustrates how researchers hope to teach their computers "common sense," the next necessary breakthrough. Crevier teaches electrical engineering at ETS, the University of Quebec's School of Engineering. He previously taught at McGill University, and is the founder of

Coreco, Inc., a firm that uses artificial intelligence to let computers see through TV cameras. . . . *Readings in Groupware and Computer-Supported Cooperative Work: Assisting Human-Human Collaboration* (Morgan Kaufmann, 1993), is a recently published book written and edited by the University of Toronto's **Ronald M. Baecker**, '63, SM '64, PhD '69. The book's jacket posits that groupware and computer-supported cooperative work will revolutionize the use of computers.

Ladislav Dolansky, SM '49, EE '52, of Weston, Mass., died on April 6, 1993. Dolansky started his studies in Prague but was arrested twice by the Gestapo and forced into factory labor. After the end of WWII Dolansky completed his Prague studies and continued on to MIT and Harvard. He worked in research as an engineering professor at Northeastern University for 37 years retiring in 1989. His research dealt with mathematical analysis of complex systems and human communications in deaf-mute adults and children. He held a patent for "voiced sound display" and published several articles on the subject. Dolansky did research in engineering in the USSR, Sweden, and India. He was a member of the Acoustical Society and a senior member of the IEEE, and was past president of the Czech Society of Arts and Sciences.

VI-A INTERNSHIP PROGRAM

Beginning with this issue I will omit certain non-essential, but interesting, commentaries included in the past. The editors have informed me that space for *Course News* has become more crowded so limitations are being imposed.

The newly selected VI-A Class of '93 finds 80 EECS students joining the program, just about the same as last year, according to program director **Kevin J. O'Toole**, SM '57, NE '57 (XIII). All the VI-A faculty advisors have met with their students, who will be well into their first company assignments when this appears in print.

The American Academy of Arts and Sciences has honored two from Course VI by election to the Academy: **Amos E. Joel, Jr.**, '40, SM '42, of AT&T International, and Course VI Professor **Ronald L. Rivest**.

In July 1985, **Irwin Dorros**, '56, SM '56, and I jointly signed the agreement putting Bell Communications Research (Bellcore) on the VI-A Program. It was recently announced that Irwin, executive VP for technical services, will retire

on July 1, 1993. Irwin joined Bell Telephone Laboratories in 1956, upon graduation from MIT (incidentally, the year I left Bell Systems and joined MIT). He moved to the AT&T Co. in 1978 as assistant VP and headed up the formation of Bellcore, following the break up of AT&T, in December 1982—an illustrious career for which he received numerous awards.

Still vigorously pursuing their careers, as noted in the listing of technical sessions of the Boston Section of IEEE, the following VI-A's are giving talks: **Way C. Lee**, '83 (XIV), '83, SM '83, EE '86, PhD '89, of the Networking Research Department at Motorola Codex, whose talk is entitled "Rule-Based Routing for Quality of Service Matching in Integrated Communication Networks." at the communications chapter meeting; **Dennis D. Poulin**, '77, SM '77, senior consultant microwave systems engineer at Hewlett-Packard in Burlington, Mass., and associate lecturer in EE technology at Northeastern University, speaking on "Techniques for Large Signal Pulsed On-Wafer Measurements" at the microwave theory and techniques chapter meeting; and **Norman Wittels**, '71, SM '71, EE '74, PhD '75, co-founder of Automatix, Inc., of Billerica, and a faculty member at Worcester Polytechnic Institute, talking about "Automated Highway Inspection and Maintenance" at the robotics chapter meeting.

A current VI-A student with Tektronix, **Malay Kundu**, '94, the first recipient of the Albert A. List Foundation Fellowship in the Arts Award, will present his work via a photographic exhibition in the Jerome B. Wiesner Student Art Gallery in the Stratton Student Center.

I sadly report the death of **Sylvan G. Glick**, '39, SM '39, in Denver, Colo., on January 20, 1993. A note from **Harold R. Seykota**, '39, of Tacoma, Wash., informed us of Sylvan's death. Harold also says he enjoyed a February visit in Tacoma with **Paul E. Gray**, '54, SM '55, ScD '60, chair of the MIT Corporation.

Alums with whom we have had contact since the last column, included the following: **J. Leon Abulafia**, '60, (formerly **Jerry Abel**) stopped by the office and told us about his family and three-year-old daughter and the work he is doing as a consultant in product development in Needham, Mass. . . . **Michael D. Monegan**, '89, SM '89, writes he's in California working on software development for NeXT. . . . **Will B. Rodemann**, '44, SM '47, writes of sailing a 40-foot yawl in the Caribbean this winter, along with "keeping up with business at home in



OSU College of Engineering, Architecture and Technology Dean **Karl N. Reid, Jr.**, ScD '64 (left), presented MIT President **Charles Vest** with a special Oklahoma State University paperweight as thanks for Vest having delivered the college's third annual Lohmann Lecture.

Maine and looking forward to our 50th [class reunion in 1994].”—John Tucker, director (emeritus), VI-A Internship Program, Room 38-473, Cambridge, MA 02139-4307.

VII BIOLOGY

Leland Hartwell, PhD '64, a professor in the University of Washington's Department of Genetics, has been awarded the 1993 Lewis S. Rosenstiel Award for Distinguished Work in Basic Medical Research for his pioneering studies to understand cell division in normal and cancerous cells. Hartwell, who has been at the University of Washington since 1968, was the first person to apply genetic techniques to identify cell-cycle or cell-division-cycle genes. In the 1960s, Hartwell began to search for key regulatory genes that might define checkpoints during the cell cycle. He used an organism called budding yeast to show that each mutant cell-division-cycle gene arrests the cell at a specific stage in its cycle. Hartwell found mutations causing arrest at every stage and was able to determine the precise stage at which the action of the gene was required. . . . Susan Offner, PhD '72, was recently profiled in that *Milton Record-Transcript*. In the article, Offner, who has been teaching in the Milton, Mass., public schools since 1985, discusses her belief that instead of restricting U.S. public school education, as some advocate, the high quality that already exists in certain schools needs to be made available to all. She stressed the importance of teachers and the secondary role of computers as teaching aids to supplement teachers, not replace them. In her spare time, Offner has developed a Human Chromosome Map and Study Kit, which is being marketed to educators by Boreal Laboratories of Tonawanda, N.Y. The kit contains a "plain English" map of our human chromosomes based on the Human Genome Project. She is also a freelance textbook writer.

VIII PHYSICS

Lloyd Armstrong, Jr., '62, professor of physics and dean of the School of Arts and Sciences at The Johns Hopkins University, has been named provost and senior VP for academic affairs at the University of Southern California. The provost is USC's chief academic officer and the principal deputy to the president. All of the university's deans report to the provost, as do the libraries, the Division of Student Affairs, and a number of academic support services, including admissions and undergraduate affairs. . . . J. David Litster, PhD '65, VP and dean for research and professor of physics at MIT, has been awarded the Irving Langmuir Prize in Chemical Physics by the American Physical Society. He received the \$10,000 prize for his pioneering experimental and theoretical studies of phase transitions in unusual states of matter, using primarily light scattering and high-resolution X-ray scattering. Much of the work was carried out in collaboration with Robert J. Birgeneau, dean of the School of Science, and Cecil and Ida Green professor of physics at MIT. . . . Lawrence M. Krauss, PhD '82, is the author of *Fear of Physics: A Guide for the Perplexed* (Basic Books, Inc., 1992).

Solomon J. Buchsbaum, PhD '57, of Westfield, N.J., died on March 8, 1993. He was senior VP of AT&T Bell Laboratories in Holmdel, N.J., where he worked since 1958. During that time, he performed theoretical and experimental research in gaseous and solid state

plasmas. Under the Bush Administration, Buchsbaum served as a member of the President's Council of Advisers on Science and Technology and as a senior consultant to the Defense Science Board. He was a member of the MIT Corporation Development Committee, the MIT Corporation Physics Visiting Committee, the MIT Lincoln Laboratory Advisory Board, and the Stanford University School of Engineering Advisory Council, among others. He received many awards, including the Secretary of Defense Medal for Outstanding Public Service and the National Medal of Science. . . . Culter D. West, '45, of Arlington, Mass., died on March 3, 1993. West was employed as a physical chemist at Polaroid for 30 years before he retired in 1965. He was an avid bicyclist. . . . The Association of Alumni and Alumnae has been notified that Joseph R. Perkins, Jr., '39, of Newark, Del., died on January 24, 1992. No further information was provided.

X CHEMICAL ENGINEERING

C.P. Marion, ScD '52, writes: "My wife, our younger son, G. Toby Marion, SM '71, and his wife and two children, and I, cruised from Mamaroneck, N.Y., to Boston last July in our Nonsuch 30 sailboat. We moored in Marblehead and anchored in Boston Harbor to view the 1992 Parade of Tall Ships for the Columbus Quincentennial."

X-A PRACTICE SCHOOL

From Las Cruces, N. Mex., Edward F. Thode, '42, SM '43, ScD '47, writes a thoughtful and informative letter giving (among other things) several "leads" for the infamous "snipe hunt" report written some 50 years ago at the Bangor Station. Unfortunately, we're still looking and will welcome further suggestions. Thode writes that "most of my time in retirement is spent on church and community affairs. I help out the ChE Department at New Mexico State University now and then, most recently by team teaching an extension course on handling hazardous materials." From time to time, Thode writes, he and Francisco R. Del Valle, '54, SM '56, SM '57, PhD '65, "swap Practice School stories." Del Valle is currently professor of chemical engineering at NMSU.

John P. Snyder, SM '49, who now lives in Reston, Va., has retired twice—once from a career in chemical engineering with CIBA Pharmaceuticals Co. in Summit, N.J., and then as a cartographer (specializing in map projections, his hobby even while a SCEP student) with the U.S. Geological Survey. Just after his second retirement, Snyder was president (1990-91) of the American Cartographic Association.

In his questionnaire for *The Flagship*, the late Milton H. Clapp, SM '29, recalled that in 1931, in the midst of the Great Depression, he was hired to be technical assistant to the superintendent of refining in a thermal cracking plant in Louisiana. It was a decision that some of the locals found hard to understand: Clapp had no refining experience, the youngest employee had seven years with the company, Clapp had no relatives in the main office, and his New England accent set him far apart—some of the locals couldn't (or wouldn't) even understand him. But, Clapp wrote in comments that were crowded out of *The Flagship* before publication, "a better training program than SCEP could not have been planned." In 1960, by then with Esso in New York City, Clapp was responsible for forecasting demand for aviation fuel substantially higher

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MIT'S FIRST SCIENCE DEAN

A Pioneer Food Technologist

The story has it that one morning soon after he arrived in Cambridge, Karl Taylor Compton, president of MIT from 1930 to 1949, emerged from his second-floor office above the infinite corridor to detect the bouquet of remarkably aromatic coffee. Following his nose, Compton came to a small suite of offices just below the main library. There he encountered Professor Samuel Cate Prescott, Class of 1894, presiding over the Coffee Research Laboratory, and a long friendship was born.

The story may be apocryphal. But two things it implies are certain:

- MIT's Department of Biology and Public Health had an academic laboratory—perhaps the only one ever in the U.S.—devoted to the analytical chemistry of coffee (including a “tasting squad” of faculty, staff, and administrators) under Prescott's direction.

- When Compton arrived from Princeton to take up his new post, Prescott quickly became a close friend and trusted confidant.

The problems of MIT and its management seem to have been less arduous in those days. The Institute faculty and administration were a fellowship of like-minded individuals who did at least part of their decision-making over meatloaf-and-mashed-potatoes lunches at a Walton's cafeteria in a rather dilapidated building opposite 77 Massachusetts Avenue.

Enthusiasts of such simpler times, as well as followers of the history of food technology and of MIT, will be pleased to hear of the publication last spring of a well researched and friendly biography of Prescott by one of his favorite former students, Samuel A. Goldblith, '40. Goldblith is professor emeritus of food technology and retired in 1986 as MIT's vice-president for resource development. His book, *Samuel Cate Prescott: M.I.T. Dean and Pioneer Food Technologist*, is the first volume in a series on food science pioneers by the Food and Nutrition Press, based in Trumbull, Conn.

Prescott came from a farm family in South Hampton, N.H.—origins that



Arriving first as a student in 1890, Samuel Prescott went on to be a faculty member (at right in 1906), department head, and (as shown above in 1936 with President Karl Compton on his right and Dean of Engineering Vannevar Bush on his left) the first dean of science.

were typical of many students during MIT's first half-century. He majored in chemistry and also studied bacteriology under the pioneer sanitary technologist William T. Sedgwick, his most influential mentor. After graduation, Prescott was given a job as Sedgwick's assistant in the fall of 1894—apparently a private arrangement, since there is no record of the appointment in MIT's ledgers. A year later Prescott's name first appeared on the Institute payroll, where it remained for the next 47 years, until retirement in 1942.

By 1903, when Prescott achieved the rank of assistant professor, at \$1,200 per annum, his research had already defined a new role for biological science in industry. Foods were the first products affected by industrial biology, principally through improvement of such processes as canning, brewing, refrigeration, freez-

ing, and packaging. Prescott worked first on canning with William L. Underwood, whose family's company was famous for canned ham and other meat products.

The work of Prescott and his colleagues was the beginning of a professional discipline that became known as food technology. A curriculum in the field became an option in Course VII, biology, in the 1920s, and in 1939 food technology became a separate department. Though his teaching, research, consulting, and public speaking were related to food quality and preservation, Prescott chose to remain at the helm of the Department of Biology and Public Health, the post to which he had been named on Sedgwick's death 1921.

When Compton created the School of Science in 1932, he made Prescott the first dean. Unlike the deans of MIT's two other schools, engineering and architecture, however, Prescott also stayed on as department head. Such an inherent conflict of interest would be unthinkable in today's environment, and in due course it brought difficulties to the MIT of 50 years ago.

During the 1930s, the fields of biology and public health and the Institute were all changing in ways that made much of Prescott's bacteriological expertise less relevant. Public health moved increasingly into the domain of medicine, and the study of living organisms was being revolutionized by new technologies—notably the electron microscope. Prescott understood the importance of these new developments and indeed made changes in the department and its curricula in response to them—including a new four-year program in biological engineering from which the first students graduated in 1939. But the subjects he knew best were no longer high on MIT's agenda. The unmistakable message that he was out of touch came when the responsibili-

ties for choosing a new head of the Biology Department and for overseeing the department's operations were removed from his domain and fell instead to John W. M. Bunker, a biochemist who was dean of the Graduate School, and to the president's office.

Goldblith, himself a student in food technology at the time of these developments, insists that the record gives no hint of rancor or frustration on Prescott's part. Prescott's ability to dismiss the frustrations that most people would have felt under these circumstances speaks to his self-discipline and—especially—to his extraordinary loyalty to MIT.

Prescott further demonstrated that loyalty when he was elected secretary of his Class of 1894 upon graduation. From then until 1961—a span of 67 years, surely an all-time record—his classmates benefitted from reports in essentially every issue of *Technology Review*. He was elected president of the Alumni Association for 1927–28, making him the first of only three members of the faculty thus honored in the 117 years of the Association's existence.

Prescott's principal passion after retiring from MIT in 1942 was a book-length history of MIT, from the founder's vision through the move from Boston to Cambridge in 1916. Despite advancing age and failing eyesight, he invested six years of research and writing in *When MIT Was Boston Tech* (MIT Press, 1954). In a foreword to the book, James R. Killian, Jr., '26, then president of the Institute, noted Prescott's special qualifications as an historian: in two-thirds of a century of association with MIT, Prescott had known all of its presidents save founder William Barton Rogers. "[Prescott] has known the Institute from the vantage point of student, teacher, department head, dean, alumnus, and parent. He has had a formative influence on its policy-making and he has been an articulate protagonist of its program and policies," wrote Killian. Reason enough to rejoice in the publication of Goldblith's authoritative biography.—*John Mattill* □

than government estimates; subsequent events proved him right, and fortunately the industry had the needed capacity. Clapp's last assignment for Exxon was design and construction of a refinery and associated facilities in Greece. Retired to Edgecomb, Maine, Clapp died on December 1, 1991. . . . Another Depression experience was described for *The Flagship* by Robert T. Billings, '32, SM '33, who now lives in Wilmington, Del. Billings distributed some 30 copies of his resume as he neared the end of his MIT career, and there was only one reply—a "no" from the Dupont Co. "that left a slight crack open for continued exchanges of correspondence," Billings wrote. He credits the Practice School experience with his eventually winning a laborer's job (\$4.50/hr.) at Du Pont's Arlington, N.J., plant. Billings retired from Du Pont about 1980. . . . George R. Jasney, SM '51 wrote that his SCEP experience at the Oak Ridge Station in 1950 was the start of a 39-year career at Oak Ridge that was "exciting, challenging, and rewarding." He continues part-time work with Martin Marietta Energy Systems in Oak Ridge. . . . In the same way, his work at the Bangor Station led Edward Pool, '32, to a lifelong career in the paper business, most of it in Augusta, Maine, where he is now retired.

From Miami, Lorenzo A. Lamadrid, '44, president of InterAmerican Energy Corp., wrote that he considers SCEP "an excellent ending to a good chemical engineering curriculum and ideal preparation for work." SCEP runs in the family: Lorenzo's son, Lorenzo Cesar Lamadrid, SM '74, is vice-president of aeronautical marketing and business development at General Electric in Vilanova, Pa.

Mrs. Ellen Walter has informed the Alumni Association of the death on February 21, 1993, of her husband John F. Walter, ScD '40, in Clarendon Hills, Ill., at the age of 80. Walter entered MIT after undergraduate work at Notre Dame; he was department vice-president at Universal Oil Products Co. when he retired in 1980. . . . Louis Long, Jr., SM '25, died at the Deaconess Home in Concord, Mass., on November 22, 1992; further information was not provided.—John Mattill, *Technology Review*, Room W59-200, MIT, Cambridge, MA 02139.

XI URBAN STUDIES AND PLANNING

From Brussels, Belgium, Marina Alberti, PhD '92, writes: "I am currently part of the task force established by the Commission of the European Communities (CEC) to create the European Environmental Agency (EEA). The EEA will have the task of monitoring the state of the environment in Europe and to provide policy makers with the information to develop and implement the community environmental policy. At present we are involved in the preparation of the first Pan European report on the state of the environment, requested by the environmental ministers of all European countries (including Central and Eastern Europe) for the development of a Pan European Environmental Program." . . . Peter Coe Verbica, SM '92, sends word from San Jose, Calif.: "I am president and CEO of the Coe Corp., a real estate holding company; former president and CEO of AMS+ (a business services company); trustee and asset manager of various private trusts; and trustee of KTEH-TV Channel 54, De Saisset Museum, and the San Jose Repertory Theater. I am a committee member of the YMCA '93 current campaign and am pursuing a career in investment banking." . . . From Jamaica Plain, Mass., Jonathan Raab, PhD '92, reports: "I am an independent energy consultant working with the state public utility commissions on reg-

ulating the energy planning activities of electric and gas utilities. My dissertation will soon be published as a book, *Improving Electric Utility Regulation* (ACEEE Press)." . . . Michael S. Giaimo, MCP '85, writes from Sherborn, Mass.: "I am an attorney practicing land use and environmental law with the Boston firm of Rackemann, Sawyer, and Brewster." . . . Douglas H. Johnson, PhD '79, has been named to the board of directors of the Providence Energy Corp., in Providence, R.I. Johnson is VP and managing partner at M. Van Leesten Associates, Inc., also in Providence.

XIII OCEAN ENGINEERING

From Yorktown, Va., Commander John S. Hefron, SM '88, NE '88, writes: "I am now the SSN 688 project officer at the U.S. Navy Supervisor of Shipbuilding in Newport News, Va. In December 1992, I completed a very successful tour as repair officer at the submarine support facility in Groton, Conn. That command was selected by the Navy as the large command best-managed intermediate maintenance facility in the Atlantic Fleet. My wife, Liz, worked with Lieutenant Commander Jeff Reed, SM '87, NE '87, at the Supervisor of Shipbuilding in Groton before she followed me to Virginia. Our daughters, Sarah and Victoria, are fine. My wife and I visited Louise and Mark Gray, SM '87, in Ottawa and shared American Thanksgiving with Canadians. Mark and I had beers with Gene Joelson, SM '87, SM '87 (II)." . . . Captain Gordon D. Marsh, SM '76 (II), OCE '76, was recently awarded the Coast Guard Humanitarian Service Medal while serving at the Coast Guard Marine Safety Office in San Juan, Puerto Rico. According to a C.G. news release, "He received it for extraordinary service during the period from October 1, 1991 through November 1992. During this period, the men and women of the Coast Guard undertook several massive operations that involved the entire service in selfless acts of humanitarian assistance far beyond the call of duty. During this time Marsh participated with other members of the Coast Guard in duties ranging from maritime search and rescue, and marine environmental protection, to national defense and law enforcement." . . . Randall G. Richards, OCE '90, recently participated in a commissioning ceremony aboard the submarine USS *Springfield*, homeported in Groton, Conn. This ship is the seventh ship of the Los Angeles class (nuclear-powered attack submarines).

The Association of Alumni and Alumnae has been notified that Reynold R. Kraft, Jr., SM '48, of Beaumont, Tex., died on September 26, 1992. There was no further information provided.

XIV ECONOMICS



William Vaughn

William M. Vaughn, III, PhD '70, has been promoted to senior VP for support services at the Stop & Shop Supermarket Co. Vaughn has served as VP in the same capacity since 1986. He began his career with the company in 1971 as assistant manager of labor relations. From April 1973 until June 1974, he served with the Cost of Living

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Council as executive director of the Food Industry Wage & Salary Committee and as deputy administrator of the Office of Wage Stabilization. He returned to Stop & Shop in 1974 and has held several positions since.

XV MANAGEMENT

From Katonah, N.Y., **Stuart Scott, Jr.**, SM '83, writes: "After two years of program development and set-up, The Reverse Mortgage Co. has been launched. I am a founder and principal. This is truly a business with a future, as its end-user customers are all over 62 years old. Check the demographics for the next 25-30 years. Then check the condition of social security. A wrenching career change was well worth it." . . . **Captain Charles C. Holcomb**, SM '75, reports: "I am VP and director of South Carolina operations for Arthur D. Little, Inc., program systems management company." . . . **Suellen Fausel**, SM '86, sends word: "My husband, Chuck, graduated from seminary in May; we should be settled at our new congregation by mid-August! Chapin is 19 months old (March 20), talking a mile a minute, and growing tall like Mommy. I'm working flex (from home mostly) for Delco Electronics. Whatta great life!" . . . **Mark S. Rangell**, SM '89, writes: "I am now working as a product manager for Medical Economics Data, one of the leading providers of healthcare information products and services. Son, Brian, recently turned two and we're expecting our second child in June." . . . **From Rome, Italy, Luca Battaglini**, SM '89, sends word: "I left the research department to join the finance department/treasury operations as an analyst. I am responsible for market analysis and planning. The company, IMI (Istituto Mobiliare Italiano), is undergoing privatization and will join with a major bank by year's end." . . . **Major Max McDonald**, SM '89, transportation advisor to the 21st Theater Army Area Command in Kaiserslautern, Germany, has received a Federal 100 award for his efforts as agent of change in the federal information technology arena. "Federal Computer Week's third annual Federal 100 award honored 100 people who have an extraordinary ability to manage, influence, and shape the government systems community. McDonald developed the Mode Tracking System (MTS) in Enable integrated software, giving the 27th Transportation Battalion control over expenses for moving equipment and personnel throughout the European Theater. MTS was baptized under fire during Desert Storm. It helped the military deliver and track more than 35,000 combat vehicles on 600 trains in six weeks and 336,000 tons of munitions over a longer period, compressing two years of work into a three-month period. MTS also made sure that 24,000 vehicles were redeployed from the Saudi Arabia ports to their home bases," according to an Enable Software, Inc., news release. . . . **Laurie S. Dean**, SM '92, has been promoted to manager of business development at Aerodyne Research, Inc., in Billerica, Mass. She will be instrumental in developing new business, diversification, long-term business strategy, and planning and nurturing ongoing customer relationships for the Advanced Systems Group. Dean will concentrate on markets for sensing technology, observable control, and environmental change. . . . **Glenn A. Armbruster**, SM '78, has been named VP for materials and logistics management at Dell Computer Corp. in Austin, Tex. Armbruster had been group quality manager at Digital Equipment Corp. in Westford, Mass. . . . **Richard A. Derbes**, SM '71, is managing direc-

tor at Gleacher & Co. Previously he held the same title at Morgan Stanley & Co., Inc. Both firms are in New York City. . . . **Robert S. Hamada**, SM '61, PhD '69, has been named dean of the University of Chicago's Graduate School of Business. He was previously the Edward Eagle Brown Professor of Finance at the university. . . . **Jeffrey L. Shames**, SM '83, has been promoted to president and COO at Massachusetts Financial Services Co. in Boston, Mass. Previously he was senior executive VP and chief equity officer; in addition to his new responsibilities, he retains the latter title. . . . **Effective May 1993, Theresa M. Stone**, SM '76, is director of Margaretten & Co., Inc., in Perth Amboy, N.J. Stone continues as senior VP at The Chubb Corp. in Warren, N.J.

Sloan Fellows

Albert Gravalles, SM '68, writes from Arlington, Va.: "I am manager of the Eastern region of DMJM, an international full-service architecture/engineering firm, based in Washington, D.C."

Trevor A. Fisk, SM '76, of Haddonfield, N.J., died on March 14, 1993. Fisk was former VP for external relations at Thomas Jefferson University Hospital in Philadelphia, Pa. Fisk joined the hospital in 1985 as the associate director of marketing and planning. He was also a lecturer at the Wharton School of Business Administration, an adjunct assistant professor at Robert Wood Johnson School of Medicine, and a lecturer in health-care marketing at Thomas Jefferson University College of Allied Health Sciences. From 1978-85, Fisk was VP for marketing and planning at Cooper Hospital University medical Center in Camden, N.J. A native of Wales, he was also employed by the British Steel Corp. from 1969-78 where he was responsible for national and international government relations and marketing and corporate communications. He was recently named editor of the *Journal of Health Care Marketing* of the American Marketing Association.

Senior Executives

George H. Babikian, '66, has retired as senior VP at Atlantic Richfield Co., in Los Angeles. . . . **Jong Y. Yun**, '88, sends word that he is in Suwon, Kyungki-Do, in the Republic of Korea.

Management of Technology Program

Jeff Peterson, SM '91, is now engaged to be married to Mary McRoberts and Junior (the dog!). The wedding will be on September 11 in Richmond, Va. Jeff is working as an independent consultant now. . . . **Mark Emery**, SM '91, and **Gary Hight**, SM '92, visited the program office in advance of attending the ILP Symposium "Universal Personal Communications." Gary continues as the director of Federal Regulatory for Bellsouth ("I am not a lobbyist.") Mark has a new position with American Personal Communications as VP for network development. Both Mark and Gary are located in Washington, D.C., and have learned much about the politics of regulatory policy. . . . **Andries Botha**, SM '92, and his wife, Rouxne, have a new baby daughter, Rolandi, born on March 28, 1993. He writes, "She is so cute!! You should see me help change nappies and burping her after she has eaten!" Both she and Rouxne are doing well. . . . **Hidetake Tak Kai**, SM '92, was in town at the end of April to meet with Arthur D. Little headquarters management. He is greatly enjoying his work as a consultant for ADL in Japan. He is consulting in

information technology and corporate/product strategies. One of his projects is for NTT where he works with Koichi Hagishima, SM '92.—MOT Program, MIT, Room E56-304, Cambridge, MA 02139

XVI AERONAUTICS AND ASTRONAUTICS



John Sullivan

John P. Sullivan, SM '69, ScD '73, has been named head of the School of Aeronautics and Astronautics at Purdue University in West Lafayette, Indiana. Prior to this appointment he was associate head and professor in the department. Sullivan joined Purdue's faculty in 1975 and during his 18 years' tenure has made contributions

to the graduate and undergraduate curriculum and is especially known for the development of laboratory courses in fluid dynamics and aerodynamics. A graduate-level course he developed in experimental aerodynamics is one of the few of its kind in the country. One area of Sullivan's expertise is the aerodynamics of propellers, both single-rotating and counter-rotating. In addition, he has developed advanced laser instrumentation for aerodynamics and fluid mechanics. His research has been funded by NASA and the U.S. Navy. As director of Purdue's Aerospace Sciences Laboratory, Sullivan redesigned and constructed the Boeing Wind Tunnel, a \$500,000 state-of-the-art facility used by students to study the aerodynamics of flight vehicles. . . . Edgar Mitchell, ScD '64, is a former astronaut who lives in Boca Raton, Fla. He gave two lectures at the Science of Mind Center in his hometown. Mitchell discussed human beliefs about reality and the cosmos and how his two days on the moon in 1971 made him think of the universe as "intelligent, loving, and harmonious."

XVII POLITICAL SCIENCE

Captain Brian L. Baker, SM '92, SM '92 (I), sends word: "I am serving in Egypt with the U.S. Army Corps of Engineers as project engineer for \$40 million in construction projects for the Egyptian government." . . . William B. Quandt, PhD '68, senior fellow at the Brookings Institution, was elected to the board of trustees of the American University in Cairo, Egypt. Quandt has been with the Brookings Institution since 1979. He is also currently a senior associate with Cambridge Energy Research Associates. Prior to joining Brookings, Quandt was a member of the National Security Council staff during both the Nixon and Carter administrations. More specifically he served as President Carter's chief Middle East aide. He was also a member of the U.S. delegation to the 1978 Camp David Summit. Quandt is the author of numerous books and articles on the Middle East, among them *Decade of Decisions* (1977), *Camp David: Peacemaking and Politics* (1986), *The United States and Egypt* (1990), and *Peace Process: American Diplomacy and the Arab-Israeli Conflict since 1967* (1993). Quandt is currently a member of the Council on Foreign Relations,

the Middle East Institute, and the Middle East Studies Association. "Founded in 1919, the American University in Cairo is a private institution of higher education engaged in teaching, research, and service exemplifying American educational principles while recognizing the heritage and mores of Egypt and the surrounding Arab world. The language of instruction is English. In addition, the university offers the largest adult-education program in the Middle East (35,000 students)," states a university news release.

XXII NUCLEAR ENGINEERING

From White Rock, N.M., Steve Boerigter, SM '89 ScD '93, writes: "In January 1993 I began working at Los Alamos National Lab in A-7."

TPP TECHNOLOGY AND POLICY PROGRAM

Alexander Demacopoulos, SM '84, has been the deputy governor of the Hellenic Industrial Development Bank in Athens, Greece, for the past two years. . . . Tina Bahadori, SM '87, had a daughter in 1992 and is planning on leaving Arthur D. Little this spring. Starting in the fall of '93 she will attend the Harvard School of Public Health. . . . Kazuyoshi Matsunaga, SM '92, attended the IAEA Board of Governors Meeting in Vienna. After working for the Japanese Embassy in Washington, D.C., for six months, he returned to Tokyo and is now assigned to the Nuclear Energy Division. . . . Stacy and Ross McNutt, SM '92, are the proud parents of Andrew John. Andy was born on March 5, 1993. . . . Since returning to Tokyo, Fuyuhiko Nishimura, SM '92, has been assigned to the Thermal Power Plant Engineering Division of the Thermal Power Department in TEPCO. His responsibilities include the management of R&D activities in the Thermal Power Department, promotion to TQM, planning on the new energy park and promotion of international cooperation. Fuyu writes to us that he saw Seab Adamson, SM '92, and Mick Rookwood, SM '92, in London. . . . It is now confirmed—the rumor is true—Michael Sullivan, SM '92, and Gretchen Demone are getting married in late October 1993. Congratulations! Also, Mike is now working for Polaroid as an environmental engineer in one of their chemical manufacturing plants. . . . Christophe Malaterre, SM '93, will be moving to Norway at the end of May. In Oslo, he will be working in the National Council of Research, which will be in charge of the Eureka Chairship for a year. . . . William Lee, a TPP friend, has been working for the Environmental Evaluation Group in Albuquerque, N.M. Part of his responsibilities is to evaluate the performance assessment of WIPP.—Richard de Neufville, TPP, MIT, Room E40-252, Cambridge, MA 02139

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

Franz Schneider, '09, SM '10; April 9, 1993; Oyster Bay, N.Y.
Benjamin F. Thomas, Jr., '13; November 9, 1991; Livingston, N.J.
Norman F. Stevens, '17; 1993; Lithonia, Ga.
James F. Johnson, '20; March 3, 1992; Raleigh, N.C.

Eugene S. Clark, '21; January 3, 1993; San Diego, Calif.
Harold N. Ewertz, '21; February 26, 1991; Farmington, Conn.
Valentine Friedrich, Jr., '22; April 18, 1992; Gorham, Me.
William L. Hawes, SM '22; March 4, 1993; Washington, D.C.
Lester N. Odams, Sr., '22; March 9, 1993; Beaufort, S.C.
Frank O. Rickers, '22, SM '23; December 1, 1992; Jupiter, Fla.
Walter M. Saunders, Jr., '22, SM '23, ScD '39; March 9, 1993; Portland, Me.
Bartlett Cocke, '23; March 20, 1992; San Antonio, Tex.
John H. Hinds, '23; January 18, 1993; Clermont, Fla.
Louis A. Metz, '23; December 30, 1992; Village of Golf, Fla.
Charles F. Woodbury, '23; February 15, 1993; Winter Haven, Fla.
Carlton C. Gordon, SM '24; January 29, 1993
Gordon C. Joyce, '24; March 17, 1993; Stonington, Me.
Anthony D. Matarese, '24; April 12, 1993; Needham, Mass.
John J. McFarlin, '24; August 15, 1988; Wilmington, Del.
Elden D. Pollock, '24; June 26, 1992; Everett, Wash.
Franklin Fricker, '25; March 20, 1991; Naples, Fla.
Stephen J. Griffin, '25; February 1, 1991; Hingham, Mass.
George N. McDaniel, Jr., '25; November 28, 1991; Borger, Tex.
Karl R. Van Tassel, '25; April 11, 1993; Lake Forest, Ill.
Joel S. Tompkins, '26, SM '27; April 3, 1993; Asheville, N.C.
Selim O. Lunden, '27; July 16, 1992; West Hartford, Conn.
Edward E. Mott, '27, SM '28; March 28, 1993; Madison, N.J.
J. Gordon Collins, '28; March 9, 1993; Palm Beach, Fla.
Herman C. Jones, '31; January 27, 1993; Tampa, Fla.
George V. Larkin, '28; January 13, 1991; Winchester, Mass.
Madeline M. Leverone, '28; March 8, 1993; Boston, Mass.
Huguenin Thomas, Jr., '29; March 4, 1993; Savannah, Ga.
Gilbert C. Toone, '28, SM '30, PhD '34; April 14, 1993; Hamburg, N.Y.
George T. Logan, '29; August 30, 1991; Philadelphia, Pa.
Chaim L. Pekeris, '29, PhD '34; February 25, 1993
Ernest Gunnar Peterson, '29; November 8, 1992; Warwick, R.I.
Gilman A. Randall, '29; April 5, 1993; Boynton Beach, Fla.
Charles T. Anderson, '30; April 28, 1993; Lynfield, Mass.
Josiah S. Barrett, '30; March 26, 1993; Nantucket, Mass.
Robert A. Foster, '30, SM '31; January 7, 1992; Penacook, N.H.
Sumner L. Fuller, '30; April 8, 1993; Topsfield, Mass.
King Tow, '30; February 15, 1993; San Francisco, Calif.
Charles C. Fingar, Jr., '31; January 1, 1993; Hudson, N.Y.
Edgar Roy LeLand, '31; March 4, 1993; Wellesley, Mass.
Julien F. Phillips, '31; January 1, 1993; Glendale, Calif.

Francisco Camps Campins, ScD '33; April 7, 1993; Pelham, N.Y.
 Canfield Hadlock, PhD '33; February 11, 1993; Kennett Square, Pa.
 Joseph W. Horridge, '33; January 3, 1988; Scottsdale, Ariz.
 Joseph Dauber, '34; January 17, 1993; Laguna Hills, Calif.
 Robert M. Franklin, '34; April 9, 1993; Brewster, Mass.
 Edwin J. Geitmann, '34; December 29, 1992; Hartland, Wisc.
 Raymond B. Jewett, '34; February 15, 1993; East Dennis, Mass.
 Harvey B. Chess, III, '35; April 11, 1993; Wellesley, Mass.
 Oliver Hoag, '35; March 19, 1993; N. Bennington, Vt.
 Edward L. Dashefsky, '36; April 23, 1993; Swampscott, Mass.
 Douglas A. Elkins, SM '36; April 3, 1993; Salt Lake City, Utah
 Walther H. Mathesius, '36; April 18, 1993; Beaver, Pa.
 Kristian A. Ostby, '36; 1981
 James M. Thomson, '36; March 16, 1993; Farmington, Conn.
 Edward V. Corea, '37; April 11, 1993; Hingham, Mass.
 Arthur R. Hunt, '37; March 30, 1993; Milford, Conn.
 James W. Montgomery, SM '37; July 31 1992
 John C. Kinley, '37; October 6, 1991; Houston, Tex.
 James J. Dillon, '38; March 11, 1993
 John A. Petroskas, '38; March 19, 1993; Swarthmore, Pa.
 Joseph R. Perkins, Jr., '39; January 24, 1992; Newark, Del.
 Irving Peskoe, '39; February 27, 1993; Homestead, Fla.
 Richard D. Robbins, '39; January 7, 1993
 Stanley W. Connelly, SM '40; July 18, 1992; Birmingham, Mich.
 M. Spalding Toon, '40; March 12, 1993; Bel-leair, Fla.
 John F. Walter, ScD '40; February 21, 1993; Clarendon Hills, Ill.
 John H. Brannan, '41; March 18, 1993; Sara-sota, Fla.
 Frank V. Gandola, '41; May 27, 1989; Cleve-land, Ohio

Max Schweinsaut, Jr., '41; November 25, 1992; Attleboro, Mass.
 Robert H. Simon, '41; SM '41; March 26, 1993; San Diego, Calif.
 Victor S. Franz, '42, PhD '49; November 14, 1992; Silver Spring, Md.
 George F. Floyd, Jr., '43, SM '47; ScD '49; October 5, 1989; Placerville, Calif.
 Bernard J. Duffy, Jr., '44, '47, SM '48; Octo-ber 25, 1992; Shawnee Mission, Kan.
 Peter F. Leone, '44; May 26, 1992; Drexel Hill, Pa.
 John V. Townsend, '44; June 21, 1992; Jamestown, N.C.
 Cutler D. West, '45; March 3, 1993; Arling-ton, Mass.
 Betty Larue Stevens, Jr., '46; February 13, 1993; Oceanside, Calif.
 Marshall Walker, '46; October 29, 1989; Chaplin, Conn.
 Albert Openshaw, '47; May 21, 1991; Amster-dam, N.Y.
 Richard H. Davis, '48; March 11, 1993; Scitu-ate, Mass.
 Reynold R. Kraft, Jr., SM '48; September 26, 1992; Beaumont, Tex.
 Lan R. Lounsbury, SM '48; August 15, 1992; Toronto, Ontario, Canada
 Glen G. Macon, '48; April 1, 1993; Lake Worth, Fla.
 George W. Webb, Jr., '48, '49; April 9, 1993; Buffalo, N.Y.
 F. William Blocher, SM '49; February 28, 1993; Wyckoff, N.J.
 Richard A. Cotton, '49; December 4, 1992; Franconia, N.H.
 Ladislav Dolansky, SM '49, EE '52; April 6, 1993; Weston, Mass.
 Kenneth E. Perry, '49; November 22, 1988; Wayland, Mass.
 Aaron Glickstein, '50
 William R. Hewitt, '51; March 9, 1993; San Jose, Calif.
 Karl Kniel, '51, SM '52; March 3, 1993; Rockville, Md.
 John E. Marshall, '53; December 1, 1992; Fort Worth, Tex.
 William J. Ferrini, '54; April 3, 1993; Rome, Italy
 Abraham Perera, '54; February 19, 1993
 William J. Alston, III, '56; April 1, 1993; Ipswich, Mass.
 John J. Burke, SM '56, MAE '57, PhD '68; April 5, 1993; Chestnut Hill, Mass.
 Robert L. Cleland, '57, SM '51, PhD '57; April 29, 1993
 John G. Howard, SM '57; February 1993; Sun City Center, Fla.
 Chester W. Carter, '62; April 18, 1993; Greensboro, Vt.
 Asa F. Kinney, '62; February 15, 1993; Ken-nebunk, Me.
 James A. Ross, '62, PhD '66; March 21, 1993; Silver Spring, Md.
 Ralph C. Holmer, '63; November 15, 1992; Golden, Colo.
 David Wilson, '67; June 7, 1992; Norwalk, Conn.
 Richard E. Dupuy, Jr., '74, SM '75; November 28, 1992; Minneapolis, Minn.
 Ira C. Levine, '74, '75 SB; October 21, 1992; Laguna Beach, Calif.
 Judith A. Fairchild, '75; November 24, 1992; Sacramento, Calif.
 Trevor A. Fisk, SM '76; March 14, 1993; Haddonfield, N.J.
 Franze T. Epps, Jr., '77; July 3, 1992; Hous-ton, Tex.
 Barbara B. Kops, SM '80; January 14, 1993; Ouderkerk, The Netherlands
 John E. DeRubeis, '83, SM '84; February 19, 1993; Cold Spring Harbor, N.Y.

As some of you may remember, I was the program chair for last year's International Symposium on Computer Architecture (ISCA 92). I just returned from ISCA 93 and it felt a little funny not having been involved. More interesting was that ISCA 93 was part of the Federated Computing Research Conference, a gathering of many computing subdisciplines, from the theoretical to the practical. I found it quite rewarding and recommend feder-ated conferences to you all.

Problems

A/S 1. The late Bob High wanted to know the longest legal go game on a 2x2 board with no passes.

A/S 2. Thurston Sydnor wonders where, in the first quadrant, the curve $x^y = y^x$ intersects itself.

A/S 3. Dave Mohr has noticed that the temperature sign in his bank alternates integer readings expressing Fahrenheit and Celsius. Assuming that the readings are perfect (and perfectly rounded), for what temperature(s) is one's uncertainty of the precise temperature at a minimum?

Speed Department

A Bridge quickly from Doug Van Pat-ter.

North
 ♠ K 10 8 3
 ♥ A 9 8
 ♦ Q 3
 ♣ K J 5 2

South
 ♠ A Q J 9 2
 ♥ K 7 6 2
 ♦ A 10 5 2
 ♣ -

You are South, having reached a poor six spade contract. West leads the seven of spades. Can you find a line of play



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MER-CER ST., NEW YORK, N.Y. 10012, OR TO: GOTTLIEB@NYU.EDU

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 Kenneth L. Recker, SM '73
 Mark X. Haley, SM '75
 Robin B. Dill, '77
 Andrew F. McKown, SM '78
 Keith E. Johnson, SM '80
 Elliott I. Steinberg, SM '80
 Chris M. Erikson, SM '85
 Gretchen A. Young, SM '86
 Cristian De La Huerta,
 SM '87
 Alec D. Smith, PhD '89

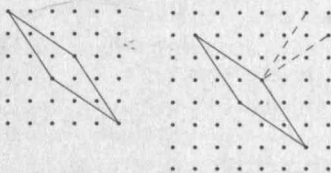
Precise to a Certain Degree

that has a reasonable chance of success given that spades split two-two?

Solutions

APR 1. Our first offering is a chess/timber problem from Winslow Hartford, who begins by pointing out that a closed knight's tour is important for timber companies since it gives a pattern for cutting sections of a forest so that successive cuts are not on adjacent land. Even better would be a closed tour of a "superknight" that moves 3 squares in one direction and 2 in the other (instead of the usual 2 and 1). The smallest chessboard containing a closed knight's tour is a 6x6. What is the smallest chess board containing a closed superknight's tour?

The following solution is from Edward Sheldon: The smallest chess board containing a closed superknight's tour is 10x10. "Odd" boards of any size do not permit a closed tour because the first and last move are odd and the move last to first, a requisite of a closed tour, is not possible. 2x2 and 4x4 boards are too small to permit consecutive moves and easily ruled out. Boards of size 6 and 8 do not work because forced moves out of corners go to the same squares and create small closed loops:



This precludes a grand tour on 6x6 and 8x8 boards. The above shows that boards of size 9 or less cannot contain a superknight's tour. At least one tour exists for a 10x10 board:

```

2 209 105 312 121 219   4 211 107 302
207 16 318 24 314 325 213 22 316 109
311 122 220 3 210 106 301 120 218 5
104 313 1 208 15 317 108 303 324 212
319 25 206 17 123 23 315 110 214 21
221 14 310 115 223 323 217 6 225 119
12 124 103 308 117 215 8 201 113 304
205 18 320 101 306 10 203 20 322 111
309 116 222 13 125 114 224 118 216 7
102 307 11 204 19 321 112 305 9 202
NOTE: 25->101, 125->201, 225->301, 325->1.

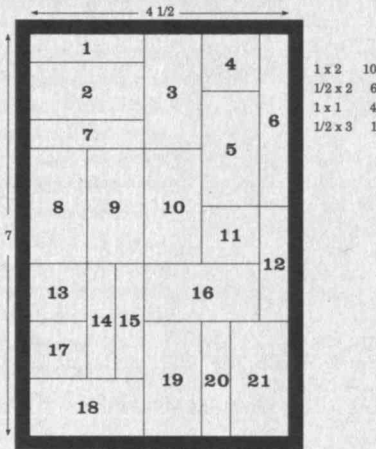
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The above was found using a recursive program written in GFA Basic on an Atari ST computer. Four-fold rotational symmetry was used to keep computation time reasonable. The above numbering scheme was used to show this symmetry.

The above is a solution because it proves that at least one superknight's tour exists on a 10x10 board and that no superknight's tour can exist on a smaller board.

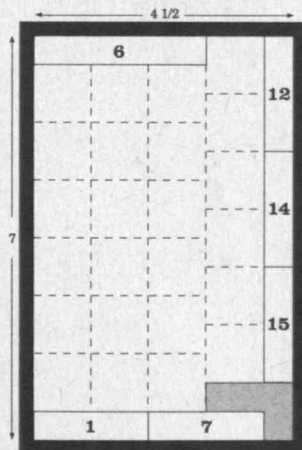
APR 2. Samuel Gluss has a set of blocks that fits nicely into a wooden box as shown below. His father, David, notes that there are many ways to pack the pieces into the box and wants

you to find one with the 1/2x3 piece (#6) placed horizontally in the upper left corner.

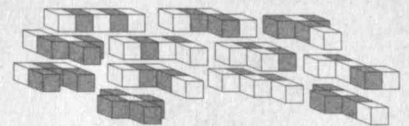


Ken Rosato shows us that such a placement is impossible:

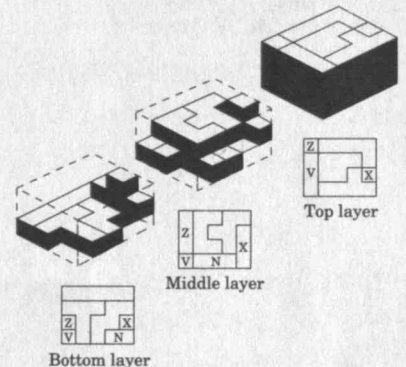
Putting the 1/2x3 piece horizontally means the entire length of it must be made up by some of the 1/2x2 pieces, to allow the 1x1 and 1x2 pieces to fit evenly in the overall length of 7. For the sake of turning this into a boundary condition problem, put them at the bottom as shown. The 4 1/2 width necessitates putting 1/2x2 pieces vertically. Put them along the right side as shown. At this point, 5 of the 6 1/2x2 pieces are used up. The right half of the right-most 1/2x2 piece on the bottom now needs to be balanced by a piece 1/2 wide, to allow the remaining pieces with a width of 1 to fit evenly in the overall length of 7. At the same time, the bottom-most 1 (up-down) x 1/2 (left-right) needs to be filled with a piece of width 1/2. Since there is only 1 remaining piece with width 1/2, it would have to be L-shaped as shown to fit. Thus there is no solution. (I think.)



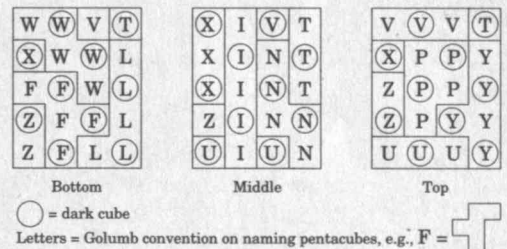
APR 3. Nob Yoshigahara wants you to pile up the 12 pentacubes shown into a 3x4x5 solid. Nob adds that the solution is unique up to mirror image.



Mike Auerbach sent us a lovely illustration from *Pentominoes* by Jon Millington.



Richard Hess notes that there are 3,940 solutions but believes that if the pieces have alternate light and dark squares the solution may be unique and offers the following example.



Better Late Than Never

OCT 2. Dudley Church has improved upon the published solution. His shortest path is 92 (or 133 if each component and not just the sum needs to be integral).

N/D 2. Eugene Sard has found a generating function capable of generating primitive solutions.

Other Responders

Responses have also been received from B. Cain, M. Fountain, and P. Manglis.

Proposer's Solution to Speed Problem

Draw two rounds of trumps and lead towards the diamond queen. If West has the king of diamonds, and hearts break 3-3, you make 12 tricks. Since West didn't lead a diamond, he may have the king. This slam was bid by 4/12 pairs and two Souths did make 12 tricks.

MIT LIFE INCOME FUNDS

MR. AND MRS. SAMUEL A. GROVES

HOME: Hancock, New Hampshire
Delray Beach, Florida

CAREER: After earning an A.B. at Dartmouth in 1931 and an S.B. in business and engineering administration from MIT in 1934, Mr. Groves took a job in the warehouse of the American Radiator Company. When he left the company in 1941, he was the chief engineer of its largest branch office. With the onset of the war, he went to work for the Boots Aircraft Nut Corporation, one of only two companies in the country that made U.S. military-approved self-locking nuts for aircraft, and he rose to the position of executive vice-president. In 1945, he joined the United Carr Fastener Corporation in Cambridge (on the site of MIT's new biology building), which made radio tube sockets, electronic connectors, and fasteners for clothing and automobiles. He became president in 1957 and chairman in 1964. In 1968, the company was acquired by TRW, and the following year Mr. Groves became a consultant for that firm. He retired in 1972.

A recipient of the Bronze Beaver Award, Mr. Groves was president of the Alumni Association and served a term on the MIT Corporation. He has been active in all of MIT's fund drives and is a founding member of the Corporation Development Committee.

Mr. and Mrs. Groves, a 1934 graduate of the Cambridge School of Architecture, married in 1935. They have two children and two grandchildren.

GIFT OF CAPITAL: The Samuel A. Groves (1934) Funds in the Rogers and MacLaurin Pooled Income Funds.

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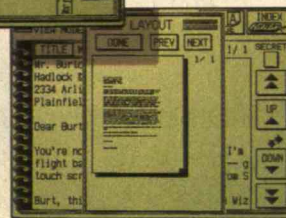
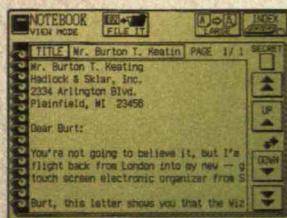
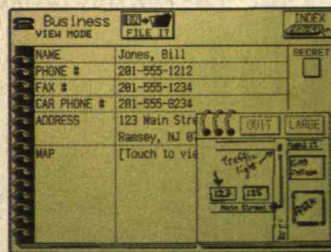
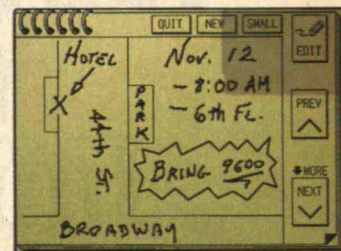
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MONDAY NOV 9, 1992	THURSDAY			
10:00- Review Meeting w/ J. Sm	21:00- Terry			
12:00- Lunch with J. Sm	21:00- Terry			
	21:00- Terry			
	21:00- Terry			
	21:00- Terry			
TUESDAY NOV 10, 1992	FRIDAY			
21:00- Jenna's Birthday	10:00- Mel			
21:00- Advertisings meet	10:00- Mel			
	10:00- Mel			
	10:00- Mel			
	10:00- Mel			
WEDNESDAY NOV 11, 1992	SATURDAY			
11:00- Meeting with Joh				
7:00- Pick up Julie at				
	SUNDAY			
	11:00- Mel			
← OCT 26- NOV 2- NOV 9- NOV 16-				



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And Burt, it's great for meetings. Once today we had a meeting and I was able to pull together all the information I needed for the meeting. I was able to pull together all the information I needed for the meeting. I was able to pull together all the information I needed for the meeting.

Burt, the Wizard 9600 is truly amazing and useful. I'll call you Tuesday to discuss the results of one.

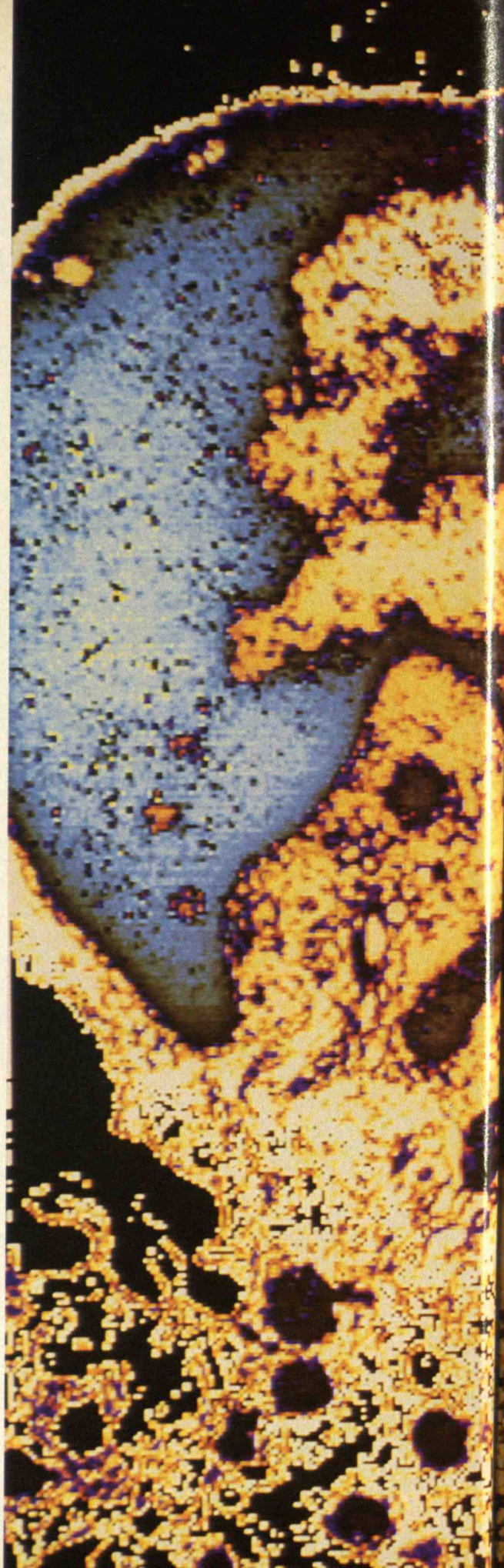
Sincerely,
Edward Caulfield

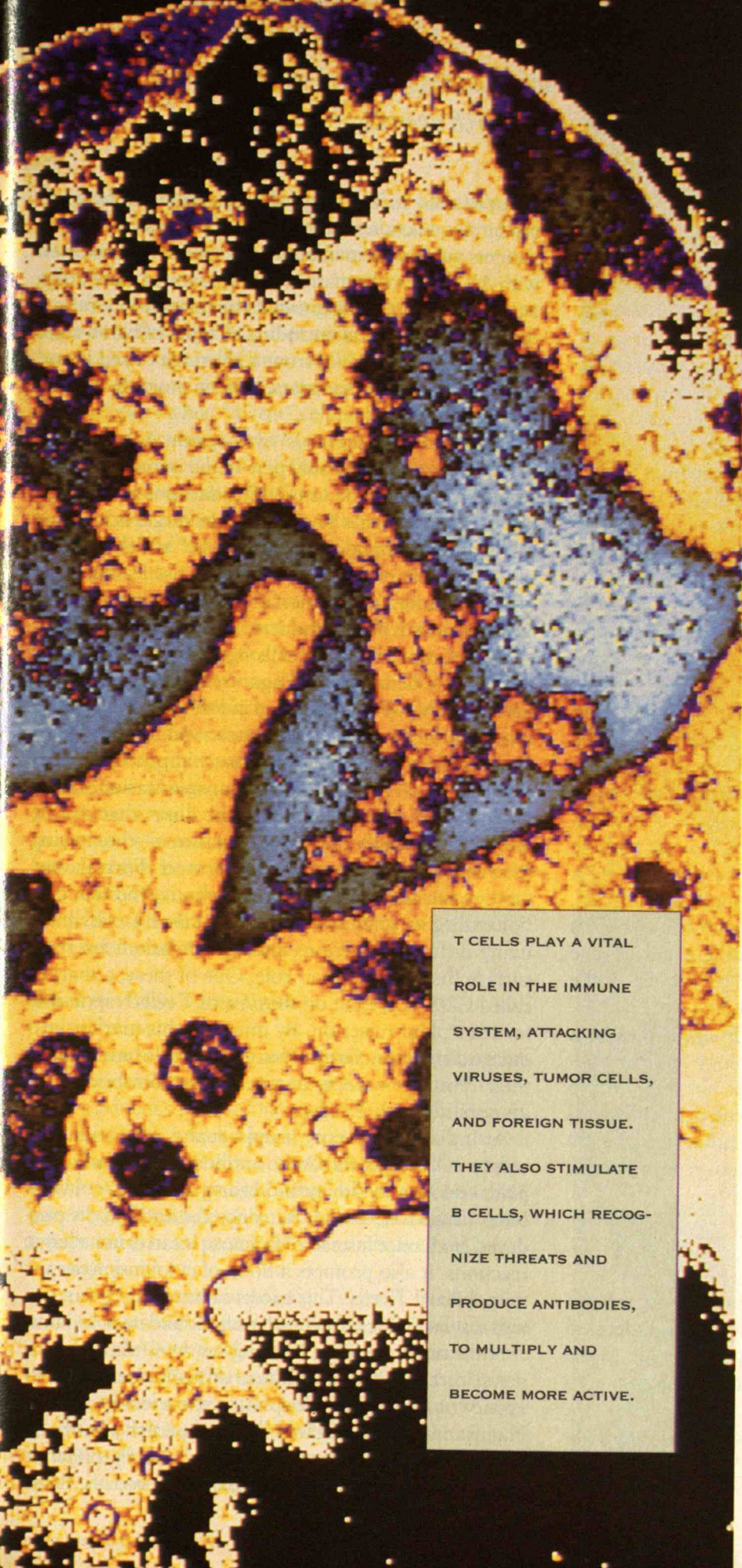
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Harnessing the Immune System

BY STELLA JONES FITZGIBBONS

WHEN AIDS arrived on the scene a little over a decade ago and a surge of immunology studies followed, the medical community already realized that our immune system does more than fight off infections. For instance, it had long been known that some cancers—even advanced ones—inexplicably disappear, which suggested that at least a few people have a way of rejecting certain types of malignant growths. It had also been known that the immune system can actually cause disease. An example is juvenile diabetes, in which hyperactive immune





Our own bodies' defenses against disease can also cause it. As research sheds light on these immune responses, ingenious new therapies are becoming available.

T CELLS PLAY A VITAL
ROLE IN THE IMMUNE
SYSTEM, ATTACKING
VIRUSES, TUMOR CELLS,
AND FOREIGN TISSUE.
THEY ALSO STIMULATE
B CELLS, WHICH RECOG-
NIZE THREATS AND
PRODUCE ANTIBODIES,
TO MULTIPLY AND
BECOME MORE ACTIVE.

*The AIDS epidemic has brought longstanding medical riddles
to the forefront of the research agenda.*

cells destroy insulin-producing cells, leading to complications that can include kidney failure, heart disease, and blindness.

One little-recognized effect of the AIDS epidemic and the resulting push to understand the immune system has been to bring medical riddles like these to the forefront of the research agenda. And in the last 10 years or so, the role that immune cells play in such widely varying conditions has indeed been clarified. Now research is aiming to make the immune system work more reliably to our advantage. Some of the most important efforts focus on the markers that have been found to distinguish the different types of immune cells—scientists can use these to devise new therapies that zero in on the problematic cells alone and are therefore more effective and easier for the patient to tolerate.

A second key area for research lies in substances called cytokines, first discovered in the 1970s. Produced by all kinds of immune cells, cytokines act as signals, stimulating receptors on the surface of other immune cells. Such signals can make the cells reacting to a virus reproduce rapidly and work faster. They can also suppress those cells when the job is finished. In other words, to see how cytokines operate is to crack the communications network of the immune system, making a whole range of innovative treatments possible. When a patient's natural defenses are not responding to threats, for example, doctors can administer synthetic cytokines to stimulate cells, and when the problem is excessive immune-system activity, receptors can be blocked, or the patient can be given suppressor cytokines.

Although performing such feats is easier said than done, the promise of recent immunology findings continues to spur researchers. They hope not only to stop the AIDS epidemic but to ease chronic debilitating illnesses such as multiple sclerosis, find powerful new weapons in the fight against cancer, and reduce the risk inherent in organ transplants.

Making Transplants Work

Attempts to manipulate the immune system began with organ transplantation in the 1950s. A transplanted organ, while it may be lifesaving, is still foreign to the body, and the immune system's natural reaction is to

try to destroy it. The original medications designed to inhibit this reaction suppressed the entire system, leaving patients vulnerable to infections as serious as those seen with AIDS. To make matters worse, many of these drugs acted not just on immune cells but on rapidly reproducing cells in general, including all types of blood cells. The result was anemia, from a shortage of red blood cells, and bleeding disorders, from a shortage of clot-forming platelets.

Sandoz Pharmaceuticals' cyclosporin A, one of the first drugs to suppress only part of the immune system, was developed in the late 1970s and put the earliest findings on cytokines to good use. Its target is immune cells called T lymphocytes, or "T cells," which do most of the work in rejecting transplanted tissue. The drug not only inhibits production of these cells but prevents existing ones from manufacturing the cytokines that stimulate other immune cells against the transplant. Since the cells that defend against bacteria and parasites can in many ways function independently of T cells, much immunity to infection is preserved.

Yet while cyclosporin A has greatly improved the success rate of all types of organ transplantation, it can cause kidney damage, limiting the doses that can be given and—for kidney transplant patients—threatening the very organ it is supposed to protect. Fortunately, more recent research has led to alternative medications. For example, scientists have found that T cells have many different functions and carry markers on their surface that identify their role. One of these, a marker called CD3, is present on the type of T cells responsible for transplant rejection. By injecting this marker into mice, scientists at Ortho Pharmaceuticals have caused their immune systems to produce an antibody that immobilizes such T cells.

At Indiana University hospitals and at Loyola University in Chicago, the Ortho antibody has halted transplant rejection in kidney and heart patients, even when other drugs have failed. But since the antibody is produced from mice instead of humans, it can cause allergic reactions. It also prompts a flood of cytokines from the immobilized T cells. This excess of immune-system signals results in side effects such as fever and muscle pains.

Some researchers are building on the Ortho work to devise therapies that avoid these difficulties. At the University of Minnesota Hospital, a team led by John S. Najarian is using drugs similar to the Ortho antibody but produced from human volunteers, so that allergic reactions are no longer a problem. Moreover, those

STELLA JONES FITZGIBBONS is a general internist with MacGregor Medical Association in Houston, where part of her practice is devoted to treating patients who have AIDS or have been infected with HIV.

drugs act on different receptors from the ones targeted by the Ortho antibody, which means that they stimulate less cytokine production—and hence cause less serious side effects.

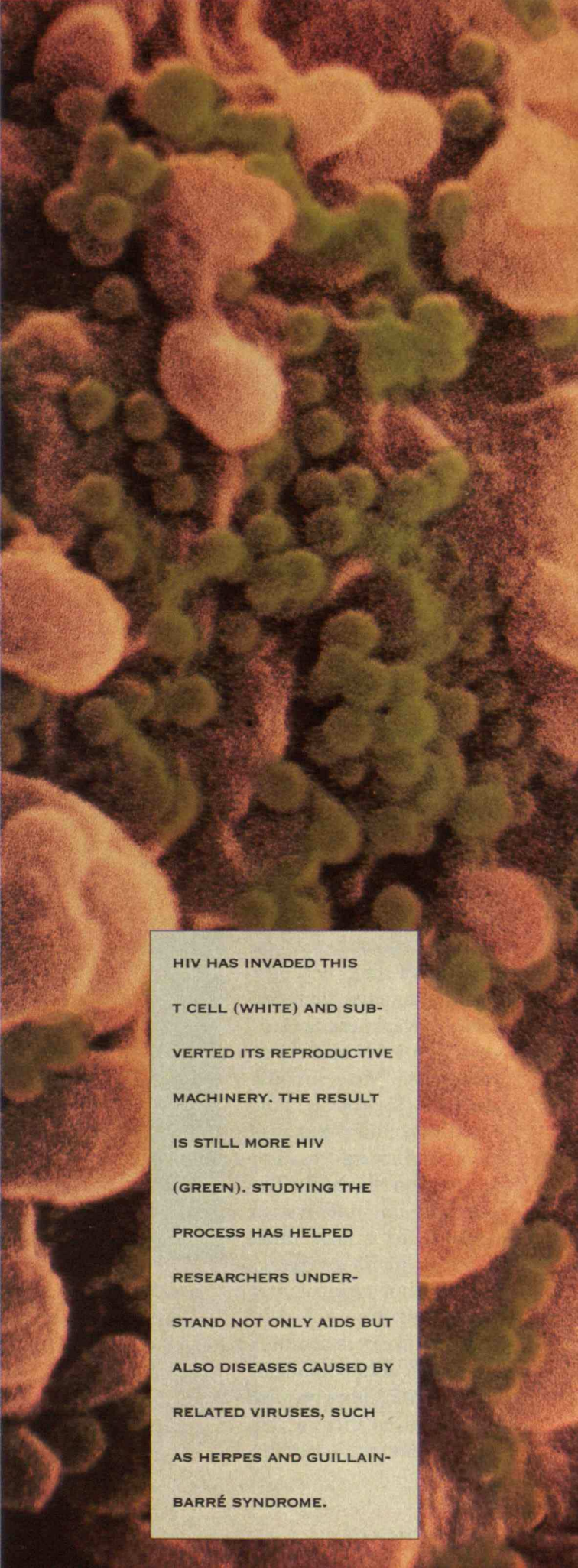
Other researchers are taking a completely different approach. For example, scientists at the Fred Hutchinson Cancer Research Center in Seattle have turned their attention to an earlier stage in the transplant-rejection process—when “alarm” cells in the immune system send out the cytokines that activate T cells against the transplant in the first place. The Seattle group has developed a substance that blocks such cytokines. This has been shown to prevent the T cells from releasing their own cytokines, the ones responsible for the troubling side effects.

In the future, we may have drugs directed at an even smaller group of cells—not just T cells of the type that *could* be activated against a transplant but the T cells within that type that actually *have* been activated. That way, still more of the immune system would be left free to defend against cancers and infections. The key lies in the knowledge that once the T cells have been activated, they carry a separate marker denoting this state. Researchers could develop antibodies against cells with that marker, in much the same way that the Ortho and Seattle teams have developed antibodies against cells with the CD3 marker. And it might be feasible to bind toxins to such antibodies, thereby killing the cells rather than just immobilizing them.

When the Body Turns Traitor

Among the most exciting areas of immunology research are illnesses in which the immune system itself sabotages a patient's health. One such disease is rheumatoid arthritis (RA), which appears to begin with an infection, possibly caused by a virus or bacteria-like organism. In susceptible people, often relatives of other RA patients, the immune system is stimulated to attack joint tissues that contain proteins similar to those of the infecting organism.

At the University of Munich, Gert B. Riethmuller and his coworkers have targeted “helper” T cells, a type found in the joint fluids of RA patients. Most of these carry a marker known as CD4. Anti-CD4 antibodies produced from mice have been found to immobilize such cells, helping roughly half the RA patients Riethmuller has looked at. The rest may have simply had too much disease activity for the small doses given to be



HIV HAS INVADDED THIS
T CELL (WHITE) AND SUB-
VERTED ITS REPRODUCTIVE
MACHINERY. THE RESULT
IS STILL MORE HIV
(GREEN). STUDYING THE
PROCESS HAS HELPED
RESEARCHERS UNDER-
STAND NOT ONLY AIDS BUT
ALSO DISEASES CAUSED BY
RELATED VIRUSES, SUCH
AS HERPES AND GUILLAIN-
BARRÉ SYNDROME.

Immunotherapy can reverse some joint tissue damage in patients with rheumatoid arthritis and may help repair nerves injured by multiple sclerosis.

effective, and larger doses would risk dangerous side effects, including the allergic reactions that result from using animals to develop antibodies. Robert H. Shmerling and David E. Trentham at Beth Israel Hospital in Boston have been pursuing a safer approach, which relies on antibodies developed from human volunteers.

Cytokine therapy might also help in treating RA. Marc Feldman and Ravinder N. Maini at the Kennedy Institute of Rheumatology in London are attempting to identify and block the receptors on T cells that allow some cytokines to activate them against joint tissue. An alternate strategy is to focus on the cytokines that help rather than harm RA patients—specifically, cytokines known as transforming growth factors. According to studies by Mary E. Brandes and coworkers at the National Institutes of Health, one of these, transforming growth factor beta, suppresses arthritis in rats. The substance both blocks the effects of the harmful cytokines and boosts the activity of immune cells called macrophages that help repair tissues. Thus it may not only slow the damage in RA but actually reverse some of it.

Another disease that has become a focus for research is multiple sclerosis (MS), which usually strikes young adults, causing nervous-system damage that can lead to weakness, loss of coordination, and even blindness. Most of the damage is to proteins in the sheath around the nerves that conduct information to and from the brain. The patient's immune system appears to attack these proteins in an overreaction to some types of viral infections.

Drugs like cyclosporin A have been disappointing in treating MS, either because they are given after the cascade of damage is already

well under way, or because the chemical structure of the medication prevents it from crossing the fatty tissues that insulate the central nervous system from the rest of the body. More recent efforts have centered on blocking the T cells leading the attack in MS, but these tactics have had only limited success. For instance, David A. Hafler and his colleagues at Harvard, who have used mouse-derived antibodies against surface markers of the T cells, have run up against the same problems with allergic response that have thwarted similar trials in transplant and RA patients.

Hafler's group is also working on "T-cell vaccination," in which surface markers from the T cells found in the spinal fluid of MS patients would be reinjected into those patients. The hope is that the markers will act like the killed virus in measles vaccine, stimulating the immune system to recognize the misbehaving T cells as a threat and destroy them. This therapy, along with

a similar oral vaccine under development at Harvard, is still in the early testing stages.

Cytokine therapy may provide another answer. One approach might be to undermine cytokines such as tumor necrosis factor and gamma interferon, which appear to be released by deranged helper T cells during "exacerbations" of MS—occasional periods when symptoms become pronounced. In fact, the practice of replacing the plasma of MS patients with plasma from healthy donors, which has been used since the early 1980s to make spontaneous remissions longer and more frequent, is now thought to work by lowering the concentration of these cytokines in the blood.

Yet as with RA, not all

◆ SOME CYTOKINES USED IN MEDICINE ◆		
NAME	FUNCTION	APPLICATION
INTERLEUKIN-2	TRANSFORMS NK LYMPHOCYTES INTO "KILLER CELLS"	PRODUCES "CUSTOM" IMMUNE CELLS AGAINST CANCERS; BLOCKING IT MAY DECREASE GRAFT REJECTION
INTERFERON ALPHA	INHIBITS VIRAL GROWTH, INCREASES B AND T CELL ACTIVITY	TREATMENT OF CHRONIC VIRAL HEPATITIS
TUMOR NECROSIS FACTOR	TOXIC TO VIRUSES AND TUMOR CELLS, INCREASES PRODUCTION OF OTHER CYTOKINES	UNDER STUDY IN CERTAIN CANCERS
TRANSFORMING GROWTH FACTOR BETA	SUPPRESSES B AND T CELL REPRODUCTION, PROMOTES WOUND HEALING AND TISSUE REPAIR	IMPROVES RECOVERY FROM SURGERY; MAY SUPPRESS AUTO-IMMUNE DISEASE, POSSIBLY DECREASE TRANSPLANT REJECTION

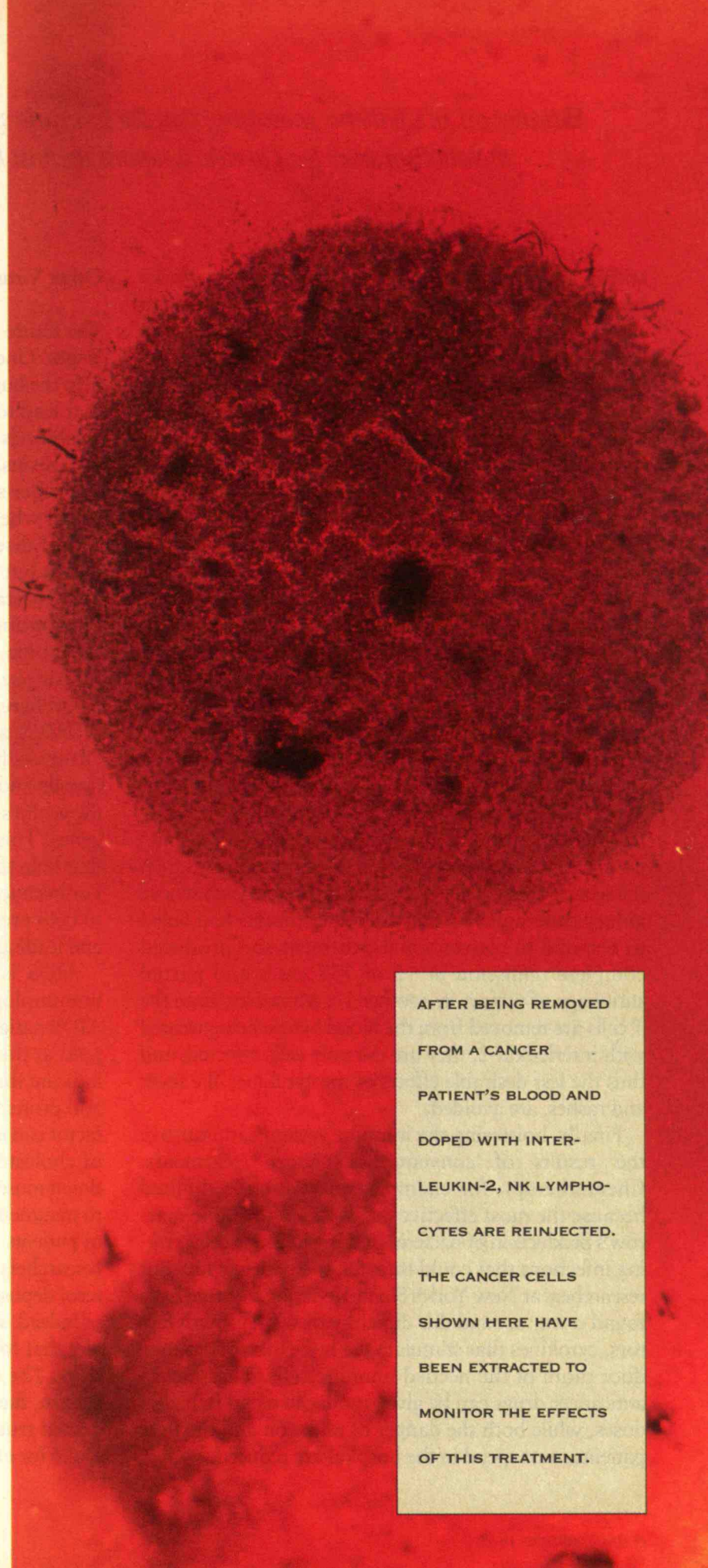
RESEARCHERS ARE DEVISING NEW THERAPIES BY EXPLOITING CYTOKINES, THE CHEMICAL SIGNALS THAT IMMUNE CELLS SEND TO ONE ANOTHER. FOR EXAMPLE, THE CYTOKINE INTERLEUKIN-2 CAN BE USED TO MAKE NK LYMPHOCYTES, WHICH ARE NATURALLY TOXIC TO TUMOR AND VIRUS-INFECTED CELLS, EVEN MORE DEADLY.

cytokines aggravate the disease—some are helpful in fighting it. The transforming growth factors already being used to heal joint tissue damaged by RA may help repair nerves injured by MS, restoring patients' mobility and vision. And in a two-year study, a group at the State University of New York in Buffalo led by Lawrence Jacobs found that MS patients who had had beta interferon, a cytokine that suppresses T cell activity, injected into their spinal fluid experienced only half as many exacerbations as untreated controls. At the end of the study, 40 percent of controls—but only 23.5 percent of the patients who had been treated—had worsening neurologic problems.

The Dilemma of Cancer

Immunology research has made significant headway in combating cancer, a disease in which cells of different organs begin multiplying without regard to the need or even the safety of the body as a whole. Because the malignant cells are manufactured by the patients themselves, most carry surface markers indicating that they belong where they are. How to get the immune system to attack native cells gone wild is a question that has puzzled researchers for decades.

During the 1970s, a host of researchers were focusing on the surface markers of cancer cells. A typical idea was to inoculate healthy volunteers with those markers and extract the antitumor antibodies that their fully operational immune systems would naturally develop. But unfortunately, malignant cells mutate so rapidly as they reproduce that newer generations lack markers, leaving nothing to distinguish them from normal cells, and nothing for antibodies to work on. Other efforts of this era were directed simply at drugs that stimulate immune-system activity. One such medication, an early-twentieth-century tuberculosis vaccine called BCG, is



AFTER BEING REMOVED
FROM A CANCER
PATIENT'S BLOOD AND
DOPED WITH INTER-
LEUKIN-2, NK LYMPHO-
CYTES ARE REINJECTED.
THE CANCER CELLS
SHOWN HERE HAVE
BEEN EXTRACTED TO
MONITOR THE EFFECTS
OF THIS TREATMENT.

Studies on AIDS patients indicating that the immune system can affect fat and protein metabolism may lead to new weapons against heart disease and strokes.

still in use against some types of cancer—it works because the same kind of T-cell attack it precipitates to destroy tuberculosis organisms also helps eradicate tumor cells.

More recently, cytokine therapy has provided an array of new strategies. The cytokines known as interferons, first extracted in the 1970s from people with viral infections, are now being used to activate many types of immune cells against cancers such as kidney tumors and certain leukemias. A cytokine called interleukin-2, critical in activating T cells, has been used since 1987 by researchers at the National Cancer Institute to reduce tumor size in malignant melanoma. Tumor necrosis factor has even broader effects. The same ability to stimulate T cells that makes this cytokine a villain in MS makes it a valuable ally against cancer. And there's a bonus: it causes malignant cells to produce more of the surface markers that allow T cells to recognize and kill them.

Since 1988, cytokines have also made it possible to produce "custom" T cells with enhanced killer instinct. Steven A. Rosenberg, Beverly S. Packard, and others at the National Cancer Institute are extracting patients' own T cells, incubating them in interleukin-2, and then reinjecting them. They've tried this with patients whose kidney cancer, melanoma, and other tumors had failed to respond to conventional treatment and produced complete remission in 12 of 137 cases and partial shrinkage of tumors in another 17. Moreover, since the T cells are removed from the blood before being treated with interleukin-2, they are the only cells affected, and thus the less desirable effects of the cytokine, like fever and rashes, are avoided.

Finally, bolstering the immune system can improve the results of conventional cancer treatments. Chemotherapy, for example, must often be limited because the most effective drugs lessen the bone marrow's production of bacteria-fighting immune cells, risking infections that could threaten the patient's life. But researchers at New York's Sloan-Kettering Institute have found a way around this difficulty through growth factors, cytokines that stimulate the bone marrow to produce more of the needed immune cells. That means anticancer drugs can be given more often and in higher doses, while both the danger of infection and the time patients must spend in the hospital are reduced.

Other Viruses, New Directions

The future of immunology research is full of new challenges. One of the most difficult is determining how to help the human body defend against the viral infections that lead to so many ailments in the first place. While antibiotics are effective against bacteria and fungal organisms, our response to viruses lags far behind, as former surgeon general C. Everett Koop acknowledged when he pointed out that "we've never cured a viral disease." Koop happened to be speaking on AIDS, but HIV is by no means the only virus causing devastating illness. The progressive liver damage of hepatitis B and C, the paralysis of Guillain-Barré syndrome, and the brain damage of viral encephalitis can also be fatal.

But here, too, there are signs of progress. The study of HIV's attack on cells has explained how related viruses—those that cause herpes, Guillain-Barré syndrome, and viral pneumonia—do their damage, forcing the victim's cells to make viral genes instead of their own genes. This has allowed scientists to design therapies that help the immune system fight some viral diseases. For instance, the cytokine alpha interferon can be given to help prevent the hepatitis B virus from reproducing and leading to liver failure.

AIDS is prompting work on other questions in immunology as well. For instance, recent studies on AIDS patients by Carl Grunfeld and Kenneth R. Feingold at the University of California at San Francisco indicate that the immune system can actually affect fat and protein metabolism. Cytokines like tumor necrosis factor can increase or decrease the storage and transport of cholesterol and other fats, and build up or break down muscle tissue. Not only could this knowledge lead to treatments that alleviate the weakness and weight loss of patients with AIDS and cancer, but it could also help researchers find ways to prevent or remove the cholesterol deposits causing heart disease and strokes.

Indeed, such insights and the diverse treatment strategies that follow in their wake are not uncommon these days. The more researchers learn about the immune system, the more complicated it seems—yet the unsuspected truths and unlikely connections they find also make for exciting opportunities. ■



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Learning from Tech

BY WADE ROUSH

ILLUSTRATIONS BY KAREN WATSON

THE seething ball of flames that marked the disintegration of the space shuttle *Challenger* shortly after launch in January 1986 has become instantly recognizable as an icon of disaster. But the broad media coverage afforded such a spectacular failure also provides a valuable opportunity: it allows lay people to scrutinize normally distant technologies and influence the policy choices surrounding them. ♦ Just as the *Challenger* disaster highlighted the pattern of design compromises and poor communications that led to the fatal O-ring failure, each new catastrophe—each Three Mile Island, Chernobyl, or *Exxon Valdez*—has the potential to reveal social and technical arrangements in dire need of change, if only we care to look. The deadly leak from

AS OUR
DEPENDENCE ON
COMPLEX MACHINES AND
SYSTEMS—AND HENCE OUR
VULNERABILITY—GROWS, IT
BECOMES IMPERATIVE THAT THE
OPPORTUNITIES DISASTERS PRE-
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BHOPAL INVEST

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DISASTER
DISASTER

Challenge
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ignored to shave costs.

Tests

Nuclear Agency

Repairs Delayed
as Crews Go to
Wrong Site

Union Carbide's chemical plant in Bhopal in 1984, for instance, not only led governments around the world to strengthen contingency plans for toxic airborne releases but also underscored the risks developing nations inevitably incur in importing technologies originally developed within the regulatory environment of the West. The period of cultural reflection following an accident can lead to measures that will help prevent similar mishaps in the future, and may even spawn changes in the array of technologies underpinning modern society.

In the case of the shuttle, change has come slowly but surely. While NASA has sent another 30 or so missions into space since *Challenger*, the agency has retooled both the shuttle fleet and its own bureaucracy. And with the growing perception that the shuttle is a costly albatross lacking a mission that justifies the risks to its crew, a new generation of unmanned rockets with equal or greater lift capacity is under development.

But whether society has made the most of such opportunities for reform is still open to question. H.G. Wells, our century's greatest technological visionary, contended that "human history becomes more and more a race between education and catastrophe." To judge from the comments of a number of social scientists and other students of disaster, education is losing that race. In the words of Lee Clarke, a sociologist at Rutgers University who has written about the reaction to the *Exxon Valdez* oil spill, "We develop modes of social organization and technology that can do very large-scale damage, and we do that faster than we develop techniques to control the damage or respond to it effectively once the inevitable disaster happens."

A Blow to Public Trust

In their social and psychological effects, technological disasters like plane crashes and toxic contaminations are very different from natural events like hurricanes and floods. Kai Erikson, a Yale University sociologist, has called them "a new species of trouble." The subtle difference between technological and natural disasters is partly captured by the story of the Buffalo Creek flood of 1972, caused by the collapse of a decidedly low-tech dam built across a coal-mining valley in West Virginia.

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Erikson's visit to Buffalo Creek shortly after the disaster revealed evidence of social and cultural damage almost worse than the flood's physical effects.

It had been raining steadily the night before the Pittston Corp.'s dam in Buffalo Creek finally broke. Just before 8 a.m. on February 26, 1972, the makeshift pile of coal slag became saturated, turned to something like Jell-O, and collapsed, releasing 132 million gallons of thick

black water into the valley of coal-mining families below. Within minutes, the thundering wall of water swept 125 people to their deaths. Hundreds more barely escaped to the hills, only to watch their family members, friends, houses, and vehicles carried away like toys. Afterward it was as if the old mining-camp towns along Buffalo Creek had never existed. Every tree, every house, every telephone pole and street sign had been scoured from the landscape.

Erikson first visited Buffalo Creek a year after the disaster as a consultant to the Washington law firm that represented some 650 of the survivors in a suit against Pittston. What he found there both depressed and fascinated him. The psychic scars borne by the survivors were far worse than one might have expected in an area struck by a tornado or a hurricane. The people of Buffalo Creek were suffering not simply from the loss of their loved ones and all their material belongings but also from a deep blow to their trust in Pittston and the other social institutions they had supposed were there to take care of them. Erikson's findings, described in his book *Everything in Its Path*, helped to define and legitimate this new kind of victimization, and to win the plaintiffs a \$13.5 million settlement. His work also inspired scholars to delve further into the social, psychological, and political aspects of technological hazards.

Events at Love Canal, N.Y., provided further evidence of the psychological damage done by technological disasters. Residents of the Niagara Falls neighborhood learned between 1976 and 1978 that their homes had been built on the edge of a long-forgotten industrial waste dump containing high levels of toxic chemicals. Press accounts led to national attention and state and federal investigations that confirmed a suspiciously high incidence of miscarriages. Prodded by local activists, the federal government eventually bought up most of the land in Love Canal and relocated its families. But the insidiousness of the toxic threat has caused continuing stress, not to mention painful social stigmatization, for many former Love Canal homeowners. The disaster

WADE ROUSH, a contributing writer for *Technology Review* and a PhD candidate in MIT's Program in Science, Technology, and Society, is writing his dissertation on the social impacts of technological disasters.

inspired one former Love Canal resident, Lois Gibbs, to establish what is now among the nation's most active grass-roots environmental organizations, the Citizens' Clearinghouse for Hazardous Waste.

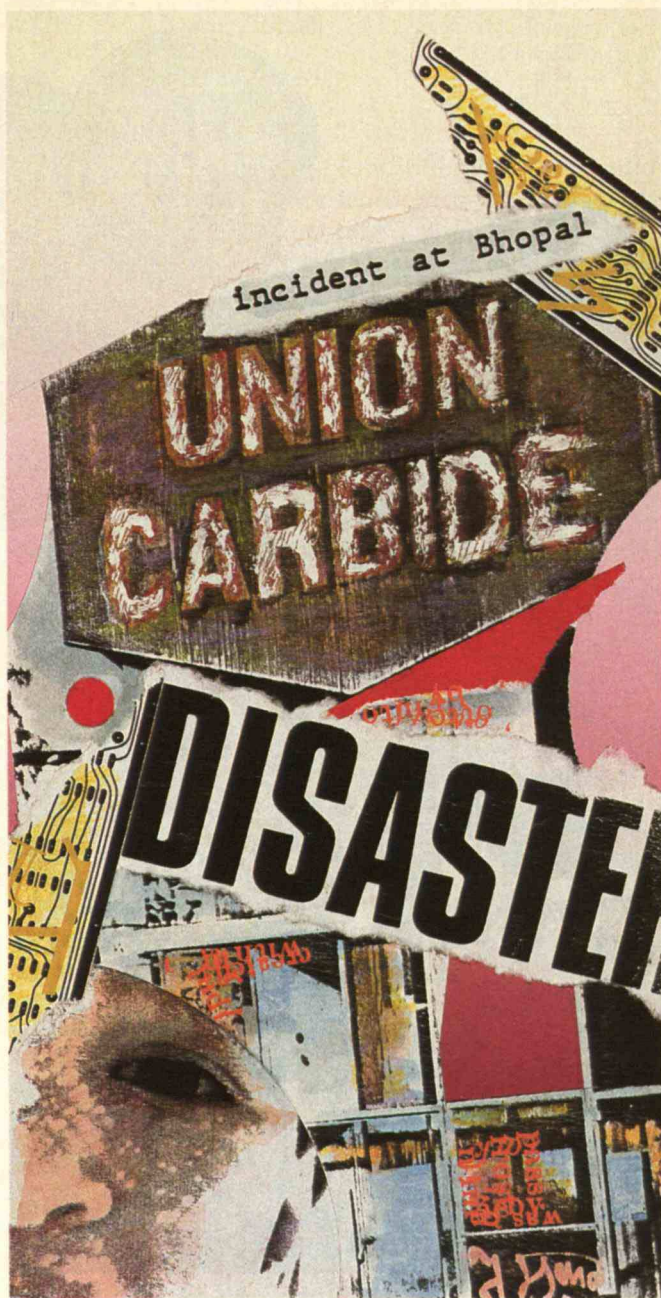
Says Erikson, "The people who have gone through these experiences are suffering forms of trauma that have not been talked about enough. What makes something like Love Canal so hard to bear, aside from the damage it does, is first of all that other human beings did it, as often as not without expressing any sorrow for having done it. But toxicity also contaminates the world in which you live in such a way that the disaster never really ends. You have this feeling that toxic materials have worked their way into the grain of the world and into the tissues of your body, and even into your children's bodies."

The feeling of personal violation stemming from a technological accident, whether mechanical or chemical, can linger for decades. As a result, technological disasters often lack the discrete endings of natural disasters. Even 14 years after the Buffalo Creek flood, psychiatrists found that those who had participated in the suit against Pittston suffered from high rates of anxiety, depression, belligerence, alcoholism, and family strife. "Rather than the restoration of normalcy," says William Freudenburg, a professor of rural sociology at the University of Wisconsin who has studied technological disasters, "you have the end of normalcy."

Organizational Inertia

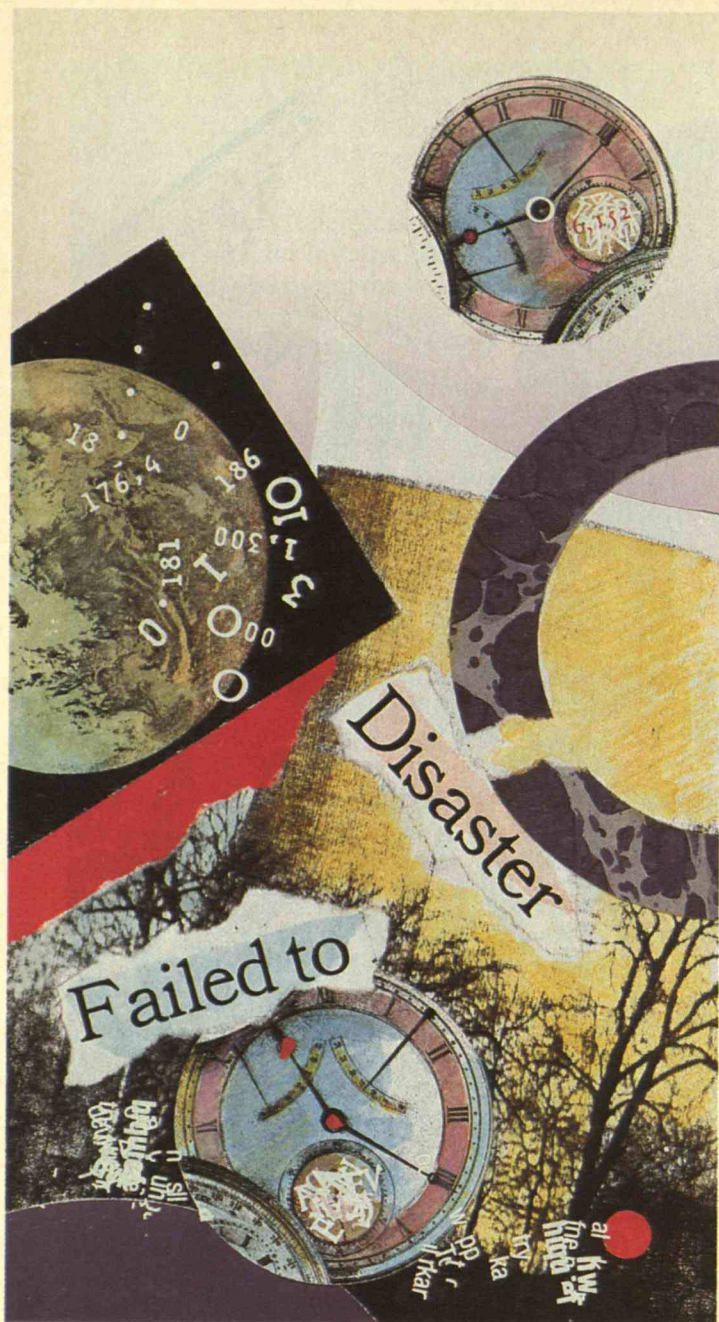
Naturally, the organizations that own and operate most large technological systems are powerful players in the drama that follows any technological disaster. These organizations will often clean up the mess, correct the technical errors that precipitated the disaster, and attempt to compensate the victims. But this is no guarantee that the complex set of conditions that made the disaster possible—decisions, investments, and behaviors—will be modified or even examined with a critical eye.

Clarke at Rutgers, for example, argues that before the *Exxon Valdez* spill the organizations charged with monitoring oil shipments acted out an elaborate charade to reassure a wary public that adequate contingency plans existed for controlling spills following major tanker accidents. Plans approved by the Alaska Department of Environmental Conservation called for containment booms to be deployed on the sea surface and dispersants to be spread from the air, neither of which were actually available in Prince William Sound the day of the accident. In fact, as Clarke points out, no large oil spill has ever been successfully contained. The plans, he



asserts, were mainly a cover for Congress's 1973 decision, amidst the first Arab oil crisis, to develop Alaskan oil fields no matter what the risks to the environment. When political and economic factors like these are in play, says Clarke, "it's hard to see how organizations and elites are going to be devoting time and resources to thinking seriously about what these kinds of disasters mean for modern society."

But the complex political genesis of many disasters does not in itself explain why accidents so rarely lead to widespread reforms that might eliminate the possibility of future catastrophes. For that, one must turn to a simpler consideration: the cost of capital. As Roger McCarthy, an engineer who heads Failure Analysis Associates in Menlo Park, Calif., points out, "The sys-



The individuals I've talked to in regulatory agencies and corporations, including Exxon, all care very deeply about the environment. They didn't want that oil spill to happen. Nonetheless, there is an institutional neglect of low-probability, high-consequence events."

Disasters as Imaginative Aids

The job of leveling informed criticism—and making it stick—thus falls to the public at large. But citizens must first overcome the notion that they are unqualified to act as critics of existing and proposed technologies. History provides all too many examples of the harm that results when lay people see modern technology as something they can neither understand nor influence.

A heartening countertrend is seen in the hundreds of grass-roots movements that have sprung up to prevent or affect the siting of toxic waste dumps, incinerators, and repositories for spent nuclear fuel. But if such groups aim to influence more than just isolated facilities, they must be equipped with workable alternative visions for our technological existence. They need a philosophy that embraces the possibility of jettisoning certain parts of society's technological inheritance and introducing new ones.

Such a philosophy can be elusive. If the *Hindenburg* disaster brought an end to passenger travel by dirigible, why didn't the *Exxon Valdez* spill prompt a thorough reconsideration of U.S. energy policy in Alaska? Why didn't the *Challenger* accident provoke an outcry against a space transportation system that many now agree is too expensive, too dangerous, and without a real mission? The answers to such questions may lie in a certain lack of imagination. If we cannot envision technological arrangements different from those we now abide, then we are truly, like Dr. Frankenstein, the prisoners of our own inventions.

It was to point out exactly this predicament that Langdon Winner, a political scientist at Rensselaer Polytechnic Institute who taught at MIT during the late '70s, asked his MIT students to give up a technology of their choosing—such as mechanical transportation, processed foods, electric light, refrigeration, or computers—for one full week. "The students soon realized that what seemed to be a very simple task was almost impossible to carry out," says Winner. "Students came in and said, 'I could only do it for four days out of the seven.' The point wasn't to get them to complete the whole assignment, but to carry it to the point where they began to discover how much of their activity, which they saw as free and autonomous, was actually woven into these products and systems and techniques."

Winner says he has never expected to see this exer-

tems that involve huge energy reservoirs and therefore the highest potential for catastrophic accidents are also the ones where huge amounts of capital are tied up." Despite the frequency of fires and explosions at petroleum refineries, for example, there has been no move to modify our current system of energy production and distribution. "We have billions invested in refineries and we are not going to be able to disinvest in them," says McCarthy. "We do not have a choice in the matter."

Then why don't corporations and governments simply assume that accidents will happen, and include the costs of mitigating them in the bottom line? "There is still a perception that it's more costly, politically and economically, to do something about it ahead of time," explains Clarke. "I don't think it's an evil conspiracy.

cise applied in the real world. But the fact is that technological disasters represent an opportunity for entire societies to engage in a similar kind of experiment, with much bigger stakes. A society facing a real technological disaster is presented with a choice: whether to repair the technology in question and get on with life as quickly as possible, or whether to use the facts brought to light to map out the ways in which the society depends on that technology, the extent to which these needs are legitimate, and how they might be met more safely and fairly.

Conditions of technological deprivation that we would never endure voluntarily, precisely because they are so disruptive of the social order, come along once in a while whether we like it or not. We may as well take advantage of them. The point is well illustrated by the public reaction to the great northeastern blackout of November 9, 1965, which cut off power to parts of several states, including New York City, for more than 13 hours. In a compilation of *New York Times* articles on the disaster, entitled *The Night the Lights Went Out*, editor A.M. Rosenthal wrote:

The blackout brought fears and mysteries; it also brought a certain exhilaration. In every man there is a corner of rebellion against the machine, and the blackout allowed us a brief period of freedom from its dominance. We were all delighted at the rediscovery of the importance of things that were not plugged into walls—things that were almost forgotten by us—most of all, the wonderful, wonderful candle. What a moment of triumph to know that the huge computers we really did not like and that we suspected really did not like us were lying massively dead and useless, but the old pencil sharpener still worked. It was modern man's closest equivalent to being alone on a desert island, and the great joy of making do buoyed us all. We knew we would be recaptured and brought back submissively to the prison farm of modern technology, but it was good being free, loose and on the run for a few hours.

Workers in Chicago went through a similar experience only last spring, when a subterranean flood in abandoned work tunnels knocked out power to hundreds of downtown buildings for up to a week. "This is great. I feel like a kid getting out of school because of snow," one woman told the *Chicago Tribune*. At a downtown bank, tellers were forced to do their arithmetic with pencil and paper. "I hate to say it,

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but they're kind of enjoying it," said the bank's senior vice-president. "It's an adventure."

The exhilaration of doing without a basic technology like electricity may only be possible when accompanied by the certainty that, eventually, the lights will come back on. In this sense, the experiment of disaster is brief and halfhearted, but it may have the potential to make people and institutions think twice about the technological choices they have made.

Walking Away from Nuclear Power

The emergence of a philosophy of technological alternatives strong enough to counter the inertia of established structures is as yet incomplete. One instructive precedent, however, may lie in the public reaction to the partial meltdown at the Three Mile Island nuclear power plant in Pennsylvania in March 1979.

The antinuclear crusade was one movement that gained momentum by doing something about a technological disaster, says Edward Walsh, a sociologist at Pennsylvania State University who documented the phenomenon in his 1988 book, *Democracy in the Shadows: Citizen Mobilization in the Wake of the Accident at Three Mile Island*.

The title refers both to the real shadows cast by TMI's massive cooling towers and to the figurative shadows of the nuclear industry and its overseer, the Nuclear Regulatory Commission. After the accident at TMI, Walsh spent several years interviewing antinuclear activists and sympathizers in communities near the plant, who he says came to see their situation as a "crisis of democracy." "Forced to plead their case before a federal regulatory agency symbiotically linked with the industry, even elected officials appeared powerless to prevent the restart [of the plant's undamaged Unit 1 reactor]," Walsh writes. "Nuclear technology seemed to have taken on a life of its own—with politically assured immunity from democratic processes."

Nevertheless, organized opposition to the continued operation of the TMI plant was formidable. For months after the accident, hundreds of residents turned out every week for meetings of the five main activist groups—the Susquehanna Valley Alliance, the Newberry Township Steering Committee, Three Mile Island Alert, People Against Nuclear Energy, and the Antinuclear Group Representing York (ANGRY). In May 1979, 150,000 people attended an antinuclear rally in Washington, D.C. Protest groups pushed Pennsylvania

Governor Richard Thornburgh to petition the NRC for a suspension of TMI's operating license, which the agency granted in July pending restart hearings.

At those hearings, which began in October 1980, activists carefully marshalled evidence documenting the psychological stress residents had suffered as a result of the accident and the inadequacy of the plant's management record, safety systems, radiation monitoring, and emergency planning. Yale's Erikson, whose study of the Buffalo Creek disaster had become well known, testified that plans for evacuating the TMI area in an emergency were unrealistic, since they failed to take into account the special psychological onus of invisible radiation. Evacuation workers were unlikely to carry out their emergency tasks, he said, if their own families were threatened.

The five commissioners of the NRC paid little heed to these arguments, but a series of damaging revelations about the internal affairs of General Public Utilities, the plant's owner, delayed until May 1985 the commission's 4-1 vote allowing Unit 1 to restart. The decision sparked court appeals and widespread civil disobedience. After a circuit court stay against the restart order was lifted by the U.S. Supreme Court, the local citizens' groups were defeated. The *Harrisburg Patriot* commented in an editorial, "Democratic rule is one of the more conspicuous victims lying in the [TMI] rubble. The rights of citizens have been trampled."

Despite this trampling, the six-year Battle of Three Mile Island removed any doubt among local residents of the need for citizens to exert an influence in the technological realm. "Not only have significant majorities been alerted to the perils of naive trust in political and economic elites, but grass-roots organizations have sprouted and intertwined with other citizen groups around the world to monitor this technology," says Walsh. During the Vietnam War, syndicated columnist Mary McGrory called the southeastern Pennsylvania region "the confidence-in-authority capital of the country." Since the accident, Walsh reports, the area's inhabitants are "much more suspicious, more involved. They know they can be agents of change."

Yet the most significant reforms to emerge from the accident at TMI occurred well beyond the local level. In the 14 years since the accident, all new commercial reactors ordered in the U.S. have been canceled—exactly the kind of industrywide disinvestment that many observers would have called implausible.

It's difficult to say whether public opposition aroused

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by the accident was the primary cause of the nuclear industry's retrenchment, since regulatory delays, difficulty meeting projected electrical output, and nervousness among financiers had slowed plant construction to a trickle even before Three Mile Island. Nonetheless, the accident spawned a worldwide reassessment of nuclear power, its environmental impact, and its compatibility with democracy. Ignited by TMI—and further fueled by the 1986 explosion at Chernobyl—normally compliant Japanese citizens have blocked the siting of new reactors in their communities, and the Swedish people have voted to phase out nuclear power entirely. In Germany, as in the United States, there has been a de facto moratorium on the construction of new plants. "TMI really was a watershed," says Margarita Crocker, a PhD candidate in nuclear engineering at MIT who has spent the last seven years doing field work on the industry and its regulation in the U.S., Germany, France, and Japan. "U.S. technology was symbolic of the state of the art. If something could happen here, there was a notion it could happen elsewhere."

At least as disturbing as the technical aspects of the accident at TMI was the obvious confusion it caused among those who were supposed to be managing and regulating the industry. Pennsylvania officials first ordered the evacuation of everyone within a five-mile radius of the plant, then retracted their order, and then issued a new warning to pregnant women and small children. Experts warned of a potentially explosive hydrogen bubble building up inside the reactor containment vessel, then changed their minds. "People saw the disorganization of the system," says Crocker. "They saw technical experts not knowing what was going on, and I think that made people very uncomfortable."

After the accidents at TMI and Chernobyl demonstrated the nuclear establishment's fallibility, the alternatives to nuclear power and all it implies suddenly became plainer. "For a lot of people," says Langdon Winner, "the choice was, do you pump up this juggernaut, or do you reexamine the whole situation and look at conservation, renewable energy, different mixes of energy, and other areas of social planning? And to a large extent, the public and important institutions did walk away from nuclear power."

Doses of Realism

Just as shadow is the result of illumination, disasters are the inevitable sequel of technological innovation.

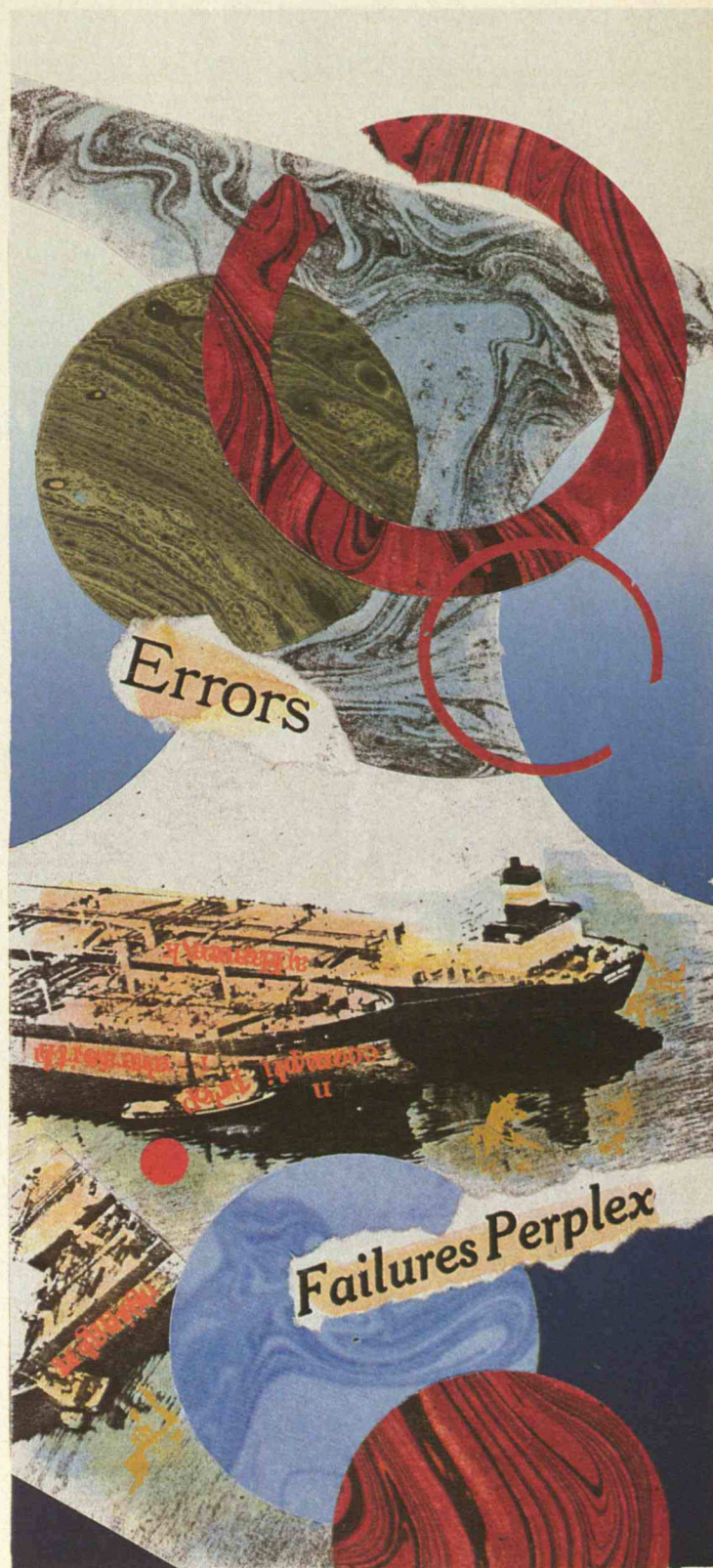
As Ernie Piper, a special assistant to former Alaska governor Steve Cowper during the *Exxon Valdez* oil spill, recently told *Alaska* magazine: "Society is not honest with itself about what industrial development means. The public expects there is, somewhere, somehow, a way of doing it safely, with no real negative impact. The idea is that there's a solution to every problem, and somebody just needs to do the math."

Large doses of realism may be on the way. Disaster researchers warn that both the frequency and severity of technological accidents are likely to grow. Henry Quarantelli, a sociologist with the Disaster Research Center at the University of Delaware, explains, "Continual industrialization will create both more and worse kinds of disaster agents. In addition to the chemical and the nuclear and so forth, we're creating new ones like genetic engineering and the possibility of computer-type disasters," such as the glitch at an AT&T switching station in Manhattan in 1991 that disrupted air traffic control all along the East Coast and delayed flights for hours. "We're also getting increasing urbanization in the world," Quarantelli adds, which means that more people are living in proximity to high-risk technologies.

Of course, fear of accidents is unlikely to drive our society to give up the cornucopia of technologies in which it has invested so much money and creativity, and which makes our lives so much easier than those of our grandparents. But neither is this what we are required to do if we are to make the best use of disasters. We must simply recognize that each Love Canal, each Bhopal, each *Exxon Valdez* can serve to revive public debate about how best to control and share the risks and benefits of modern technology.

Given Americans' usual apathy toward public affairs, it is unreasonable to expect a groundswell among the whole population. But at least two groups have the requisite background and motivation to be mobilized by disaster.

First, there is the "attentive public," defined by Jon D. Miller, a professor of political science at Northern Illinois University, as the roughly 10 percent of the population that is sufficiently interested and well informed about technological matters to want to register its opinions. Members of this group, because they are more likely to write letters to newspaper editors, call in to TV or radio talk shows, or contact their representatives, can have a crucial impact on policymaking. Second are the victims themselves, who know firsthand the human costs of technological accidents and have intensely personal reasons for banding together to win redress and prevent future accidents. Together these two groups may be able to persuade the rest of society to turn disasters to good account. ■





A FORK IN THE

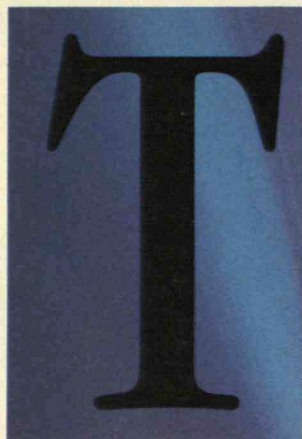


By DAVID CALLAHAN

ROAD TO SPACE

MOUNTING FISCAL PRESSURE
ON NASA MAY FORCE A SHIFT
FROM HIGH-PROFILE HUMAN
MISSIONS LIKE THE SPACE STATION
TO UNPILOTED EARTH OBSERVATION
AND SPACE SCIENCE—WHICH
MIGHT NOT BE SO BAD.

PHOTO ILLUSTRATION BY RALPH MERCER



THIRTY-FIVE years ago, in the wake of the first Sputnik, a group of top White House scientists issued a report on the future of U.S. space exploration. Although the challenges of space travel were then only barely comprehended, the report, entitled *Introduction to Outer Space*, predicted steady progress in placing human beings in orbit, sending piloted craft to the moon, and exploring Mars and

other planets. The United States has since made spectacular strides toward realizing all those dreams.

Today, however, President Bill Clinton confronts a space effort in trouble. Fiscally, there are tough questions about whether the National Aeronautics and Space Administration will have the resources to pay for all the projects it now has in the pipeline. More broadly, many critics believe that the space program has lost its direction, and wonder whether an ambitious space program has become an unaffordable luxury in this age of towering deficits and worsening social ills.

Most immediately, NASA faces strong resistance to its central program, the proposed space station, which Congress has come close to canceling two years in a row. On June 17, President Clinton approved a revised version of the space station, shrinking its size and cutting its costs, which the General Accounting Office (GAO) had estimated at a hefty \$40 billion to deploy and \$78 billion to operate into the twenty-first century. Clinton had already announced, in early April, that NASA would collaborate with Russia in the station project. Although numerous technical and political uncertainties surround such a proposition, this step has the potential to further reduce the space station's cost through the use of Russian hardware like the *Mir* space station and the 20-story Energia rocket. U.S.-Russian cooperation on the station could also represent a paradigm shift in the way the world conducts its space activities, with the two largest spacefaring nations finally putting aside political differences to pool their resources.

But neither redesign nor the new partnership with Russia is certain to save the space station program. Some on Capitol Hill say the station will still be unaffordable, and they question the benefits of a permanent

U.S. presence in space. (On June 23, the House came within one vote of canceling the station program.) A greater appreciation of the dangers of piloted spaceflight in the wake of the 1986 *Challenger* accident has compounded doubts about NASA's plans.

Despite these problems, there remains a determined commitment in many quarters to continuing a high-profile piloted space program. At the grass-roots level, legions of "space buffs" believe fervently in America's destiny to explore space. In Washington, space funding is vigorously promoted by the powerful aerospace lobby, legislators whose constituents benefit from space spending, and NASA itself, which has historically been adept at public relations.

The space coalition also counts among its allies a number of top political leaders, including Vice-President Al Gore, formerly chair of the Senate Subcommittee on Science, Space, and Technology. The United States cannot afford to ignore current domestic problems, Gore said last year, but nor can it abandon a long-term investment in space.

As steward of this investment, President Clinton must reconcile ambitious goals with limited means. According to estimates by the GAO, there is a significant gap between the cost of NASA's planned programs and the level of funding the agency can expect from Congress over the next five years. Despite recent efforts by NASA to close this gap through various cost-saving measures, it may no longer be possible to avoid hard choices among major space policy priorities.

Two distinct paths are clearly discernible: under one, piloted space exploration in close cooperation with Russia would reign as NASA's top priority, and the space station would serve as the flagship of this effort. But according to GAO analyses, pursuing this vision—even assuming significant savings from the redesign of the space station and a partnership with Russia—would probably drain funds from a range of important space science projects.

Under the alternative path, NASA would engage in a far-reaching retrenchment and curtail its piloted space exploration plans. While few analysts have spelled out what the U.S. space program might look like without a major piloted component, several changes would seem inevitable. The space station would be canceled, shuttle flights would be scaled back, and NASA would defer indefinitely the long-standing dream of placing human beings permanently in space and sending them to Mars and beyond. In the years ahead, NASA would continue its popular space science programs while giving new prominence to programs for studying global environmental problems and to research efforts in technology with commercial applications. Instead of selling itself

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as the agency that is spearheading humankind's exploration of the heavens, NASA would play up its role in improving life on planet earth and enhancing U.S. industrial competitiveness.

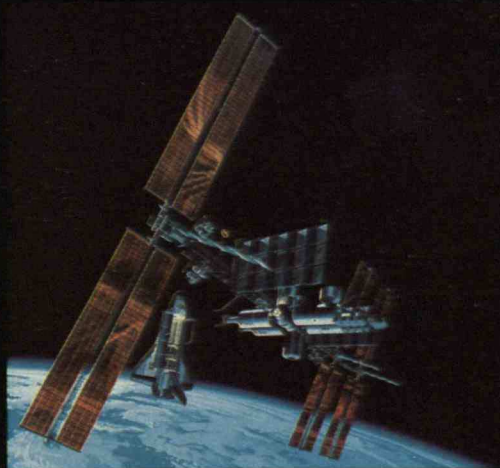
Faced with tough political choices, Bill Clinton has often sought to find a middle way. His effort to keep the space station alive with a less costly design is typical of this penchant for compromise. However, as Clinton faces the fork in the road of American space policy, he may have little choice but to pick one direction or the other.

NASA's Funding Crunch

The Bush years were good to NASA. In July 1989, six months after taking office, Bush declared that the United States should build a permanent base on the moon and journey to Mars early in the next century. He reestablished the defunct White House National Space Council and gave Vice-President Dan Quayle, as head of that body, free rein to push a vigorous space policy at the highest levels of government. At NASA, a new Office of Exploration was created to plan for America's eventual return to the moon and trip to Mars. NASA's budget climbed from \$9 billion in 1988 to \$14 billion in 1991.

On the surface, a second golden age of U.S. space exploration appeared to be at hand as the 1990s dawned—arriving just in time, some thought, to offset concerns about America's declining global status. "We must lead in space if we are to lead on earth," declared Bush. "I am fully committed to the peaceful exploration of near and far space. I am convinced this is not only an adventure but a responsibility, and one we shirk at our peril."

But fiscal reality cut short the second golden age before it even began. In 1990, NASA officials were counting on annual budget increases of up to 10 percent in real dollars through the end of the decade. Yet within a year, most budget experts had come to believe that NASA funding would barely keep up with inflation during the 1990s. Through 1991 and 1992, policy analysts and lawmakers alike warned that NASA was failing to adjust to these new fiscal conditions and that its vision of the future was untenable. In March 1992, GAO analyst Neal P. Curtin estimated that NASA's planned five-year program would require \$92.4 billion in spending through fiscal year 1997. For this to be achieved, said Curtin, the agency's budget would have to grow significantly each year to over \$21 billion



NASA'S REDESIGNED SPACE STATION (A PRELIMINARY VERSION OF WHICH IS DEPICTED AT TOP) IS SMALLER AND HAS LESS POWER AND DATA-PROCESSING CAPACITY THAN THE EARLIER 356-FOOT-LONG DESIGN (BOTTOM). BUT THE NEW DESIGN WILL STILL COST SOME \$16.5 BILLION BY THE YEAR 2001, ON TOP OF THE \$9 BILLION ALREADY SPENT.

by fiscal 1997. "There appears to be a serious mismatch between NASA's program plans and the budget resources that seem likely to be available," he said.

Sometime last year, the ticking sound from NASA's budgetary time bomb reached the ears of its new administrator, Daniel Goldin. Since taking office, Goldin has acknowledged the magnitude of the crunch his agency faces. In an effort to find savings, Goldin has pitted "Blue Teams" of program managers against "Red Teams" of in-house program critics. According to NASA, these competing teams have already found ways to cut future program costs by 17 percent.

Other savings are also projected. Since last year, NASA has cut planned outlays for the Earth Observing System program during the remainder of this decade from \$11 billion to \$8 billion. EOS, a proposed system of satellites for studying climate change and ozone depletion and monitoring rainforests and deserts, is the centerpiece of NASA's Mission to Planet Earth, which, as now envisioned, is a comprehensive effort to observe from space the environmental impact of human activities. NASA also promises to save nearly \$2 billion by better managing the space shuttle program over the next five years, and has reduced funding for the National Aerospace Plane, a passenger craft that would be able to fly into orbit without using a booster rocket. Finally, NASA expects substantial savings through the 1990s from restructuring the space station and cooperating with Russia. Goldin has stated that achieving these savings is crucial if NASA is to adequately fund its other priorities.

Although space analysts at the GAO acknowledge NASA's efforts at belt tightening, they see little improvement in the basic budgetary problem. Last year, when Congress approved a NASA budget of \$14.3 billion, legislators warned the space agency not to expect more than 3 to 5 percent annual growth. Heeding that warning, NASA this year requested only \$14.7 billion for fiscal 1994. In all likelihood, NASA will receive no more than \$75 billion over the next five years. But recent cost cutting notwithstanding, NASA is still trying to juggle too many programs. "Even if they got \$80 billion over five years, they still wouldn't be able to carry out their plans," says one GAO space analyst. "They'd still leave their major programs limping and bleeding."

NASA's fiscal predicament may actually be worse than the overall budget estimates indicate. A GAO report released in January pointed out NASA's habit of underestimating costs. Of 29 major programs over the last 15 years, the report concluded, 22 exceeded NASA's projections. The median cost increase for the offending programs was 77 percent. "If there is substantial growth in program cost beyond what is planned, which has his-

torically been the case, the funding gap will be ever wider," says a GAO analyst who worked on the latest report. Thus, for all of NASA's effort to adjust to fiscal reality, it may be running in place. Even if the agency's budget keeps up with inflation over the next five years, new and more substantial cuts in its program plans seem unavoidable.

The Case for an Orbital Outpost

By far the most widely discussed option for reducing NASA spending is to cancel the space station. Although the redesign has cut the station's construction and operating costs by an estimated \$27 billion, the program remains hugely expensive. NASA plans to spend over \$2 billion annually on the program over the next five years, and up to \$16.5 billion through the year 2001.

To proponents, the space station is well worth its cost. The case for a permanent U.S. presence in space is manifold, based partly on claims about the scientific, medical, and commercial benefits that a station could yield, and partly on the inspirational arguments long invoked to justify piloted space projects. The station "is essential for advancing the human exploration of space and will lead to discoveries we cannot yet fully appreciate or comprehend," said a top NASA official, Arnold Aldrich, last year. "By exploring the effect of microgravity in fields such as biotechnology, materials science, and combustion science, we hope to discover the role gravity plays in the growth of living cells, the formation of crystallizing solids, and combustion processes. By exploring the long-term effects of microgravity on living systems, we hope to discover how gravity has affected the evolution of life on our planet. Development of effective countermeasures to the changes caused by microgravity will enable humans to live and work productively in space and to apply this knowledge to the advancement of health care on earth."

This last point, on the potential medical benefits of space research, is among the most often emphasized—and most controversial—arguments in favor of building the station. Bernadine Healy, director of the National Institutes of Health under President Bush, argued last year that medical research in space could provide insights into such problems as cardiovascular disease, osteoporosis (loss of bone minerals), muscle atrophy, inner ear disturbances, and the consequences of radiation exposure. As Ronald Merrell of the University of Texas Health Science Center explained, "space-based research offers us a totally different approach to understanding these processes. We can study the body's gravity sensors and test the pulse and pressures of the cardiovascular system under entirely different conditions

than here on the ground. We are able to look at the neurosensory system from a completely different perspective and we can watch the metabolism and the way fluids and bones respond, in a process that cannot be duplicated in any other setting."

Supporters also see the space station as essential to preserving the U.S. aerospace industry, and point to the huge numbers of high-quality jobs the program is creating. During the presidential campaign, Al Gore called the aerospace industry "our last surviving crown jewel" of technological innovation that has not been eclipsed by foreign competition. "The space station will serve as an anchor for the aerospace industry, particularly during a time when high-skilled defense workers are being displaced by cutbacks. Any effort to cancel this program will be opposed, because taking such a course would only exacerbate an already difficult situation."

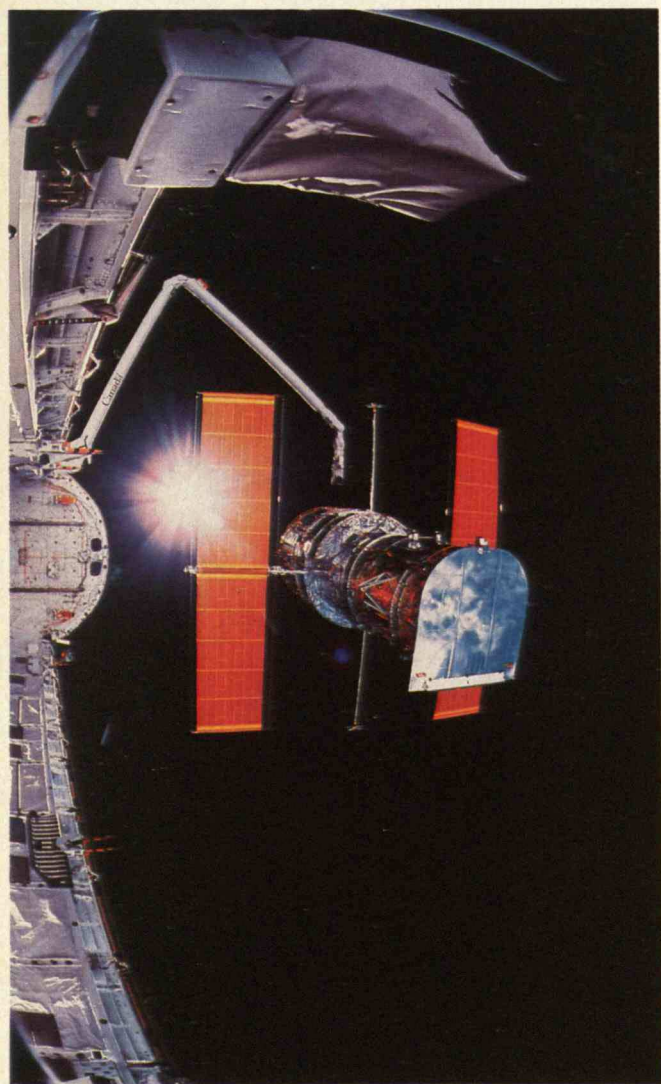


PHOTO: NASA

The economic case for the space station resonates not just with executive branch officials eager to aid America's high-tech sector but also with members of Congress. The program is expected eventually to employ 75,000 people. Perhaps not accidentally, NASA has spread contracts over 37 states and hundreds of congressional districts.

The space station doesn't just keep today's engineers and scientists employed, say enthusiasts: high-profile NASA projects help inspire the engineers and scientists of tomorrow. "Too many children believe that they can't 'do' science or that math is 'too hard,'" Administrator Goldin remarked last year. "However, these same students are fascinated by space subjects, especially astronauts." Inspirational programs like the space station, said Goldin, help to "ensure a sufficient talent pool to meet the competitive challenges of the twenty-first century." Rep. F. James Sensenbrenner, Jr. (R-Wis.), has put it more bluntly: "If we should neglect the space program we are going to see fewer and fewer students going into math and science, and we are going to pay the price for that, maybe not next year, but in the decades ahead."

SPACE SCIENCE

PROGRAMS SUCH AS THE
HUBBLE TELESCOPE,
SHOWN HERE BEING
DEPLOYED FROM THE
SHUTTLE, VIE WITH
PILOTED PROGRAMS
FOR A SHARE OF
NASA'S FLAT BUDGET.

NASA officials not only emphasize the benefits of the program that will be felt on earth but also stress that it is essential for furthering America's exploration agenda. The station will both prepare astronauts for the long stays in space that a Mars flight would entail and serve as an orbital staging site for such a mission.

Advocates also point out that even before the Russians were brought in, the space station was the largest nonmilitary international research and development project ever undertaken. Besides Russia, 10 European countries and Japan and Canada are participating in the program. NASA officials say the station will serve as a model for future cooperative technological endeavors, and warn that canceling it would badly damage U.S. credibility in the international scientific community.

Russian involvement considerably bolsters the pro-

gram's geopolitical significance. Beyond serving to solidify ties with a former rival, the move is widely advertised as a way to help reform in Russia. "A joint effort would give new purpose and direction to a Russian space industry that, nostalgic for the Cold War, remains an obstacle to reform," wrote John Pike, director of the space policy project of the Federation of American Scientists, in the *New York Times* in April. "And it would occupy Russian rocket engineers who, despairing of their prospects at home, are tempted to find work on Third World missile programs."

The Space Station in Trouble

Despite lofty arguments in its favor, the space station is under assault from all directions. Critics pursue two lines of attack: one, that it is unaffordable, whatever its value; and two, that its value is in fact wildly exaggerated.

"Quite simply, our government does not have the resources to fund a program as all-consuming as the space station while attempting to support a vast array of smaller but equally important space science and technology development programs," Sen. Ernest Hollings (D-S.C.) remarked last year. "I am one of those enthusiasts with the fire in the eyes and fire in the belly for space," said Hollings, who chairs the Commerce, Science, and Transportation Committee. "But I live in the real world."

If one accepts that something has got to give in NASA's budget, the question then becomes where to make the cuts. Nobody wants to cut deeply into NASA's other major project of the coming decade, Mission to Planet Earth, because of a widespread consensus that it will provide crucial data on environmental problems. Other reductions in space science spending—which accounts for some 20 percent of the NASA budget and includes such popular programs as the Hubble space telescope and the Magellan robotic mission to Venus—are also not palatable. In late 1990 a special advisory committee on space policy chaired by aerospace expert Norman Augustine expressed the view of many policy experts when it recommended that space science should have top priority in NASA's budget. It is this endeavor, stated the committee's final report, "that enables basic discovery and understanding that uncovers the fundamental knowledge of our own planet to improve the quality of life for all people on earth, and that stimulates the education of the scientists needed for the future."

Yet NASA's enthusiasm for the space station has already begun to bite into space science. In putting together its 1993 budget request, the agency was forced to cancel or cut back several science programs such as

the Comet Rendezvous/Asteroid Flyby robotic expedition. More such cutbacks may lie down the road as NASA begins to deploy the space station in the late 1990s and the program's annual costs rise. Under current plans, this ramp-up will occur at the same time that the expensive Earth Observing System program is slated to reach its funding peak. As one environmental lobbyist has observed, the basic problem with NASA's budgetary plans is that it has two growing children and "food enough for only one."

The space station simply cannot stand on its merits, say many critics. Medical researchers have been vocal in countering promises of health-related breakthroughs on the station. "It is extremely difficult to imagine how the conditions of space, such as low gravity, could possibly



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—VICE-PRESIDENT AL GORE



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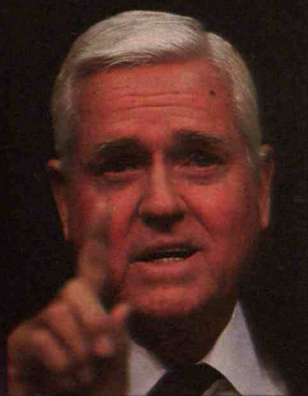
CHALLENGES OF THE TWENTY-FIRST

CENTURY." —NASA ADMINISTRATOR

DANIEL GOLDIN

add significantly to our understanding of normal growth, cancer, AIDS, or any other disease of man or other organisms on the planet," argued biologist Maxine Singer, president of the Carnegie Institution, in congressional testimony last year. Singer stressed that biomedical experiments require carefully controlled environments and immense attention to detail. A cramped and busy space station is not the place for such research.

Another witness, Veronica Catanese, co-chair for public policy of the American Federation for Clinical Research, told Congress: "NASA's life science research proposals are not bad science. They are just not good enough to be ranked above the existing programs of the National Institutes of Health and the Veterans Administration, which are seriously underfunded."



*"OUR GOVERNMENT DOES NOT
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TECHNOLOGY DEVELOPMENT PROGRAMS."*

—SEN. ERNEST HOLLINGS (D-S.C.)

Investigators in other areas, such as materials research, have also criticized NASA's scientific claims. "To date no examples have been found of materials that are worthy of manufacture in space," concluded a 1991 study of the Space Studies Board of the National Research Council. "Unless and until such examples are found, space manufacturing should not be used as a rationale for this program."

Even some space station advocates who believe in the program's medical and commercial utility worry about the obstacles to doing sustained laboratory work in space. "An orbiting manned platform would be an ideal place to conduct sophisticated biological and pharmaceutical research," says Jeffrey Manber, senior adviser to the Space Studies Institute, a private organization in Princeton, N.J. "But we need routine transportation" to fulfill the strict, long-term schedules that such research entails.

If cooperation with Russia is successful, the trouble-prone shuttle would play a smaller role in the space station program. Under previous plans, as many as 10 shuttle flights would have been needed to assemble even a smaller, redesigned station, and many more flights would have been required to maintain it. Now, NASA analysts believe that just a handful of launches by Russia's Energia rocket could loft the station into orbit. Once the station was in space, other Russian launch vehicles could supplement the shuttle in keeping it supplied.

Still, uncertainties remain, says John Logsdon, director of the Space Policy Institute at George Washington University. Given the immense political and economic turmoil in Russia, he and other experts worry that Russian cooperation on the station cannot be assured. They also worry about the reliability of the Energia, which has flown only a few times.

Amid all the arguments about the space station's scientific and economic merits, it is easy to forget about the grander dream that underpins the project. Nobody disagrees that a space station would be needed to prepare for an eventual trip to Mars, and analysts like John Pike believe Russian help makes this dream considerably more realistic. Yet station critics see a big problem: if Congress is already balking at the high cost of the space program, chances are slim that it will, in the foreseeable future, cough up hundreds of billions of dollars for a piloted mission to Mars.

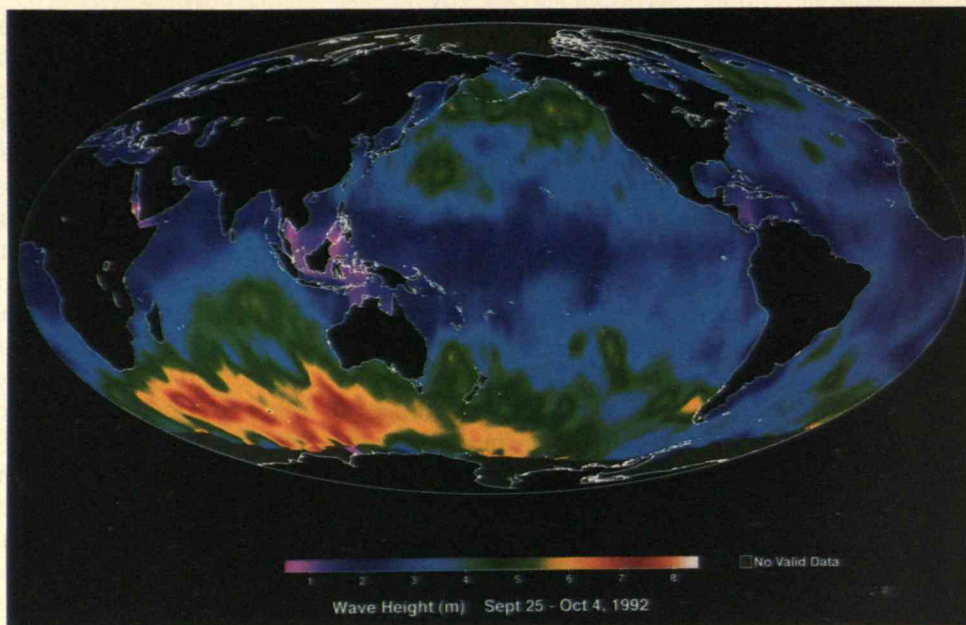
A New Space Policy?

During the presidential campaign, Clinton and Gore pledged to push ahead with the space station. But even with administration backing, the program, which has only narrowly survived in Congress over the past two

years, will continue to be vulnerable. Russia's involvement somewhat reduces that vulnerability. "It will change the political context," says Logsdon. "A vote against the program becomes a vote against Russian aid." Nevertheless, this boost has not ended efforts to kill the station on Capitol Hill.

Ironically, too, NASA's redesign of the station may actually erode support for the program, since a smaller, less capable station will be harder to justify on medical and scientific grounds. Even before the new design was announced in June, long-time supporters of the station, such as House Science Committee Chair George E. Brown, Jr. (D-Calif.), were warning that a scaled-back station might be doomed in Congress. Some observers have even suggested that the White House's real aim in ordering the redesign was to set the stage for killing the station.

Whether or not this is true, a softening of White House support could be fatal to the station's prospects. Former congressman Leon Panetta, Clinton's director of the Office of Management and Budget, has long been skeptical of NASA's long-range plans. As Panetta and other deficit hawks continue the search for budget cuts, NASA could look like an attractive target. Given Clinton's direct campaign pledge to keep the station and now Russia's involvement in the project, it is unlikely that the White House itself would ax the space station program. But as space policy expert Pike notes, a failure by the



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BY THE JOINT U.S.-FRENCH
TOPEX/POSEIDON
SATELLITE SHOWS VARIATIONS
IN WAVE HEIGHT THROUGH-
OUT THE WORLD'S OCEANS.
THE AMBITIOUS MISSION
TO PLANET EARTH, OF
WHICH TOPEX/POSEIDON
IS A PART, COULD BECOME
THE MAINSTAY OF A NEW
"GREEN" NASA.

White House to invest "political capital" in keeping the program alive could give opponents in Congress an opening. Indeed, Clinton's statement in February that he would not impede congressional debate on the program suggests that there may be limits to the political capital he is willing to expend.

The future of U.S. space policy would look fundamentally different in the absence of plans to deploy the station. Since the late 1960s, space analysts have worried that without an inspirational piloted component, the whole space program could be in jeopardy. "Politically, there are a lot of people who are uncomfortable with accepting the responsibility for halting the American piloted spaceflight program," notes Pike. It is felt that in the wake of such a move NASA's "whole house of cards would come tumbling down." The White House will not take such a prospect lightly. "Do Bill Clinton and Al Gore want to go down in the history books as the president and vice-president who shut down the space program?" Pike asks rhetorically.

Yet this fear may be exaggerated. Even without a human presence, NASA would continue to pursue ambitious space science projects that fire the public's imagination by producing new information about the solar system and the universe. A U.S. space policy without a major piloted component could also be harnessed to at least two ideas that are central to the Clinton administration's long-term thinking: technological competitiveness and environmental protection.

Proposals for sharpening NASA's commercial relevance are already emerging. In February, for ex-



ample, the Clinton administration announced that money saved by restructuring the space station would be transferred into NASA's aeronautical programs in an effort to keep U.S. aviation strong. And in May, an internal NASA report by analyst Charles D. Pellerin, Jr., said that to survive, the agency must move away from exploration for its own sake and concentrate on fostering new technologies and commercial opportunities. NASA Administrator Goldin reportedly received this advice with enthusiasm.

Many in Congress, while opposing the space station, support the general idea that funding NASA is one way to help sustain a robust high-tech sector. This goal, of course, is very different from NASA's traditional mission of exploring space. But by making a case that such research and development spending is a good investment, the Clinton administration can build political support for a space program that lacks a high-profile piloted component.

Emphasizing NASA's environmental mission can do even more to safeguard the agency's future. During a Senate hearing two years ago, Vice-President Gore argued that the agency's political future will hinge on whether it can help humankind deal with global environmental degradation. He said that NASA must clearly make this issue its top priority.

If the space station were canceled, the environmental mission would become NASA's most expensive and visible undertaking. Mission to Planet Earth could serve as a sturdy cornerstone for the space program into the next century. And a "green" NASA could continue to inspire scientific interest among young people.

NASA's most glamorous days might then have passed, but its greatest contribution to life on earth could be made in the years to come. ■

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Beyond Inter-Passive Media

DESCRPTIONS of the next generation of digital communications bubble with excitement over the prospect that television, telephone, and computing will soon merge into a single entity, spawning a host of electronic services and multibillion dollar markets. "You will 'graze' hundreds of cable channels," enthused a *Time* magazine writer, "call up a current stock quote while taking a peek at a movie, ask the TV to display the pitcher's stats during a game or the lyrics during a music video." (See "Information Highway: The Home Front," page 30.)

The name often given these possibilities—"interactive media"—suggests that people will be energetically involved and fully in control. Unfortunately, the image that prevails is one of 250 million bovine consumers with remote control switches at the ready, seeking ever more frivolous spectacles and the ecstasy of home shopping. These technologies might better be called inter-passive media, for they deny the possibility that people might initiate anything themselves.

But ferment at the grass roots seems farther advanced than the thinking of established technology planners. For the past dozen years ordinary folks have been experimenting with linking personal computers for their own ends. Schools, local governments, public interest groups, and neighborhood coalitions have been finding out how to foster communication in socially invigorating ways.

These "civic networks" let people be producers and shapers of information, not mere consumers who accept what is broadcast. They allow citizens to originate computer-aided dialogues with government decision makers and inform them about real problems and workable remedies. Users of these systems can obtain government documents and other information from original sources, rather than accept versions of events concocted by politicians and journalists.

The Youngstown Freenet in Ohio, for example, offers computer bulletin boards, electronic mail, directories of social service agencies, and online news reports. It also serves as the home for

Academy One, a network linking more than 400 elementary schools around the world. Another network, the Blacksburg Electronic Village, is a widely used community forum created through the cooperative efforts of local citizens and faculty at Virginia Polytechnic University. Such efforts have received a fresh burst of energy as people have found ways to connect to the Internet—the international "network of networks" now used by 12 million people.

Meeting in Washington last April, representatives of many such grass-roots organizations sketched a wealth of possibilities for civic networks, including education, job training, improved delivery of government services, forums for public debate, and coalition-building to tackle community problems. Still, many at the meeting expressed concerns that opportunities for such "home grown" networks are being excluded from

grotesque concentrations of power over information sources. Who will pay to put computers with network connections in schools, libraries, and nonprofit civic institutions? Unless these "on ramps" are easily available to everyone, the information highway could become a sheltered sinecure for powerful businesses and R&D labs.

What is needed now, says Civile, are numerous pilot projects, perhaps funded by public-private partnerships, to see what kinds of civic services people will use and what works. He suggests earmarking 1 percent of the \$350 million a year that President Clinton wants to spend on "community development banks" for building civic networks. The Census Bureau could survey the nation's computer owners to see how they use online services. Some fraction of the federal budget for an information infrastructure could go to study information



blueprints for tomorrow's information highway. Systems now being designed, they worry, assume technical capabilities possessed by large scientific laboratories and entertainment conglomerates; households are defined as consumption nodules, impotent at doing much more than ingesting pre-packaged cable transmissions. But Richard Civile, director of the Washington office of the Center for Civic Networking, is optimistic. He believes that attention is broadening from entertainment and scientific use of networks to ways of providing "real socio-economic benefits."

Much remains to be done to guarantee equality of access and prevent

equity—just as the Human Genome Project sets aside 5 percent of its appropriation to explore ethical issues.

The rise of civic networking raises questions about the meeting ground between technological systems and the evolution of social habits. We can emulate ancient Rome and install bread and circus machines in every home. Or we might invite ordinary folks to shape the new media in ways that reflect personally defined needs and interests. ■

LANGDON WINNER teaches science and technology studies at Rensselaer Polytechnic Institute. He is author of *Democracy in a Technological Society* (Kluwer, 1992).

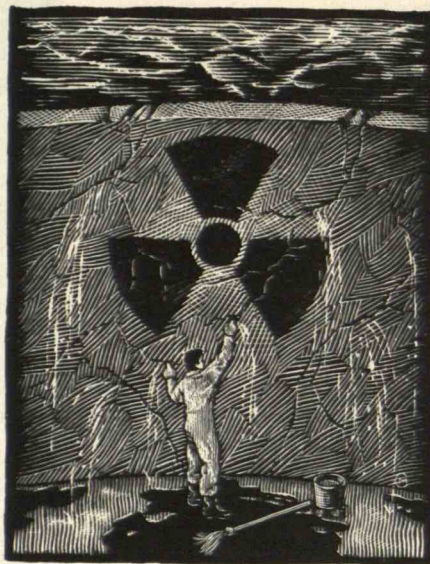
Plutonium Perils

AN international furor erupted last winter when a nuclear reprocessing plant in France shipped two tons of plutonium by ocean transport to Japan. This episode began a dangerous chapter in nuclear history.

The world will have to deal with huge quantities of plutonium over the next decade. About 100 tons of plutonium will be recovered from tens of thousands of dismantled Soviet warheads at a time when Russia's increasing economic and political chaos undermines international confidence in the security arrangements for this plutonium. On the civilian front, France and Britain have built facilities that are scheduled to extract almost 20 tons of plutonium per year from the spent fuel of Japanese and West European reactors. A country—even a sophisticated terrorist group—could use either military or civilian plutonium to make an easily transportable nuclear explosive thousands of times more powerful than the device that recently damaged the World Trade Center in New York. Plutonium is highly carcinogenic only when inhaled. Because it emits little penetrating radiation, it can be carried in a sealed container with little risk—which makes it relatively easy to steal.

The plutonium dilemma originally arose from the material's enormous potential value as a nuclear fuel. Only 0.7 percent of naturally occurring uranium is the chain-reacting isotope U-235, which provides most of the energy for today's nuclear reactors. Since the 1950s, several countries have built experimental "breeder" reactors that can transmute the U-238 that makes up the other 99.3 percent into chain-reacting plutonium, greatly increasing the energy recoverable from uranium.

But real uranium prices have dropped ten-fold in the last 15 years because of slower-than-expected growth of nuclear power generation and the discovery of new uranium deposits. At the same time, the real costs of building a plutonium breeder reactor have more than doubled. Breeder-reactor development programs in most industrial countries have therefore ground virtually to a halt.



*Dismantled weapons
and reprocessed fuel are
flooding the world
with bomb material.*

Unfortunately, the companion technology—the reprocessing of spent reactor fuel to recover plutonium—has persisted. Since the original rationale was to provide startup plutonium for breeder reactors, reprocessing ought to have died along with the breeder. It hasn't yet. Germany and Japan, in particular, have sent large quantities of spent fuel to be reprocessed in Britain and France—in effect, using reprocessing as a way to postpone domestic political confrontations over the siting of radioactive waste depositories.

This temporary reprieve is ending. The reprocessing contracts specify that the separated plutonium and radioactive waste be returned to the owner, saddling Germany and Japan with major disposal problems. Their current plan is to blend most of the plutonium with uranium to produce "mixed-oxide" fuel for standard nuclear reactors. But the cost of this mixed-oxide

fuel is seven times higher than the cost of the uranium that would otherwise be used. German, French, and Japanese utilities are therefore cutting back the amount of their spent fuel committed to reprocessing.

Because the United States rejected the commercial separation and use of plutonium as a fuel a decade ago, on both economic and nonproliferation grounds, we must look for other ways to dispose of our military plutonium. The most obvious method is for the government to build a few reactors to irradiate the plutonium in mixed-oxide fuel, making it less accessible. Mixing the plutonium with the intensely radioactive fission products that are present in irradiated fuel would make it accessible only to those who have remotely controlled chemical reprocessing facilities.

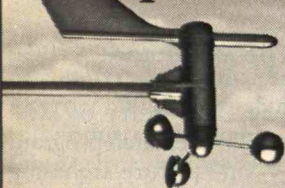
Another way to achieve the same result would be to mix the military plutonium back into the nuclear wastes from which it was separated as those wastes are glassified for underground disposal. Such "anti-reprocessing" would involve much less handling and transport of separated plutonium than using it as a fuel.

Neither alternative is likely to be embraced soon by Russia or the United States, though. Russia wants to store its surplus military plutonium to fuel future breeder reactors, and as long as this plutonium remains available for bomb-making, the United States is unlikely to get rid of its own stockpile. In the interim, U.S. policy should be to assist Russia in reinforcing safeguards on its stored plutonium of both military and civilian origin.

Russia will accept international monitoring only if the United States is willing to subject its own surplus plutonium stores to the same outside inspection. The Bush administration resisted such reciprocity. One hopes that the Clinton administration will steer a wiser course. ■

FRANK VON HIPPEL is professor of public and international affairs at Princeton University.

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The Trouble with Techno-Jingoism

IN February, Sen. Richard C. Shelby (D-Ala.) introduced legislation to rescue academic research from the taint of foreign money. His amendment to the National Institutes of Health Revitalization Act would have prohibited universities from sharing the results of research funded by NIH or the National Science Foundation with any overseas corporation to which the schools had financial ties or from which they had accepted compensation. The aim was to deter foreign firms from participating in industrial liaison programs, joint ventures, and direct sponsorship of research on U.S. campuses.

Though Shelby later withdrew the amendment in expectation of future Senate hearings on the issue, the same spirit of protectionism lives on in private industry, the news media, and think tanks. A biotechnology research center at the University of California at Irvine, for example, came under harsh scrutiny on the ABC news program *20/20* because it was built by Hitachi Chemical Research. The Center for Public Integrity, a Washington-based organization that studies issues of public service and ethics, branded the facility a "one-way mirror" on U.S. research.

Such techno-jingoism is rooted in the belief that foreign funding is predatory—that overseas companies or their U.S. subsidiaries are out to buy American brainpower. Since most basic research in the United States is paid for by the government and performed by colleges and universities, some fear that U.S. taxpayers are subsidizing innovations by our overseas competitors.

All this fuss over big yen on campus



*Efforts to shield
U.S. basic research
from foreign funding
deprive academia and
industry of valuable
opportunities.*

would be understandable if foreign companies were taking out more than they were contributing. The fact is, foreign money actually enhances U.S. competitiveness: it pays for research and education programs that might otherwise languish, and provides faculty and students with opportunities to do cutting-edge R&D.

A Boon to Science

The University of Arizona's research program on "picture archiving and communications system" technology is a good example. PACS, which will let physicians store diagnostic pictures on computer and quickly retrieve them, will ensure that medical images last longer and allow hospital radiology departments to operate more efficiently. While domestic firms have shown little interest in supporting the school's PACS research, Toshiba America Medical Systems has provided roughly \$10 million in cash and equipment.

Were it not for Toshiba's support, says William J. Dallas, a professor of radiology and optical sciences at the university, "our operation would be much, much smaller or not as advanced." Toshiba's investment also benefits U.S. industry, paying for a test facility the university uses to evaluate display monitors made by domestic firms.

Similarly, research at the University of California at Irvine on nerve growth factors, protein synthesis, and the human genome would be substantially more modest without Hitachi's biotechnology center. "The faculty and students have access to very high-quality laboratory space and facilities that would not otherwise have been available," says David Schetter, director of the Office of University/Industry Research and Technology.

Foreign sponsorship can increase the U.S. government's return on its R&D investment. This is the case at MIT's Media Lab, which gets more than 80 percent of its funding from industry. Of that, 50 percent comes from domestic

firms and 25 percent each comes from Europe and Japan. Says Nicholas Negroponte, the lab's director, "We use this industrial funding, among other things, to subsidize our U.S. government-funded research contracts through matching moneys and equipment given to us by industry."

For all the value it adds to basic research, foreign sponsorship poses little risk to the U.S. competitive position or national security. Most schools retain ownership of any technologies developed with foreign funding; overseas sponsors simply enjoy the right to negotiate an exclusive license. What's more, products arising from research that has been funded even in part by the federal government must be substantially manufactured in the United States. Universities must also comply with export-control and technology-transfer regulations designed to protect U.S. interests. In any case, basic academic research is usually published in journals, where the information is available to all.

Encouraging Reciprocity

Clearly, foreign funding is not the menace that techno-jingoists make it out to be. But if any doubt remains about whether such arrangements are fair, we should be asking not how we can restrict foreign access to U.S. research but how we can broaden U.S. access to foreign research.

Actions taken by the government in the late 1980s to encourage reciprocity serve as excellent models for future legislation and bilateral agreements. The Federal Technology Transfer Act of 1986 and a 1987 executive order by President Reagan require federal officials, when negotiating R&D agreements with foreign organizations, to consider whether the United States can arrange similar agreements in their countries. Another valuable measure is the U.S.-Japan Agreement on Cooperation in Science and Technology. Signed by President Reagan and Prime Minister Takeshita in June 1988, it contained provisions for raising the number of

American students and scientists doing research in Japan.

In this climate of greater exchange, a number of companies, including Texas Instruments and IBM, have set up basic research laboratories in Japan. The National Research Council reports that NEC and several other large Japanese companies have opened their labs to outsiders. And Japan has provided \$4 million in fellowships for U.S. scientists to do long-term postdoctoral research in Japan.

In tapping overseas research facilities, schools receiving foreign funds have a built-in advantage. "All of our Japanese sponsors extend an open invitation for our faculty and students to study and work in their companies," says MIT's Negroponte. "Japan treats old friendships with great respect, and for this reason the Media Lab has very privileged access." Likewise, students and faculty at North Carolina State University's Department of Materials Science and Engineering, which receives support from Kobe USA, have studied at the steel and machinery maker's facilities in Japan for as long as six months.

Perhaps the question Sen. Shelby and others of like mind should ponder is, "If not foreign companies, then who?" The federal government is not the benefactor it used to be. According to the National Science Foundation, the government's share of academic R&D funding dropped from 69 percent in 1971 to 56 percent in 1991. While U.S. industry has made up some of the difference, it still spends most of its research money in-house. Just two cents of every industry R&D dollar went to fund academic research in 1991. Until either government or industry promises to fill the void that would result at many schools if overseas firms were forced to pull out, techno-jingoism will remain a self-defeating and backward-looking creed. ■

ROBERT GOLDENKOFF is chair of the section on science and technology in government of the American Society for Public Administration, a professional organization based in Washington, D.C.

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Reviews

BOOKS

FILL 'ER UP WITH BIOMASS DERIVATIVES

*Renewable Energy: Sources
for Fuels and Electricity*

Thomas B. Johansson, Henry Kelly,
Amulya K.N. Reddy, and
Robert H. Williams, eds.

Island Press (Washington, D.C.), \$85/\$45

BY WILLIAM L. DRISCOLL

CALLS for action on climate change, long disregarded in the White House, have now found a receptive ear. On Earth Day in April, President Clinton made a commitment to reducing U.S. greenhouse gas emissions to 1990 levels by the year 2000. This near-term goal can be met mainly through investments in energy efficiency. But the longer-term goal of significantly slowing global warming will require a shift away from fossil fuels, which add large amounts of carbon dioxide to the atmosphere, to so-called renewable energy sources such as biomass fuels and solar cells, which generate no net CO₂ emissions.

Today, renewables make only a marginal contribution to total energy supplies; in the United States they provide just 2 percent of all energy and 11 percent of electricity. *Renewable Energy: Sources for Fuels and Electricity* maps out a scenario for developing these technologies so that by the year 2050 they supply the same amount of energy as now provided by conventional sources, including nuclear. Assuming an energy market double the size of today's, renewables would satisfy 46 percent of the world's energy demand and 45 percent of U.S. demand. At the same time, the scenario envisions oil and coal production being cut in favor of natural gas, which generates less carbon dioxide per unit of energy used. One result of these steps, says the book, would be cleaner



air. More to the point, annual CO₂ emissions would be 25 percent lower in 2050 than in 1985—low enough to stem climate change appreciably.

Optimistic as it may sound, this blueprint deserves to be taken seriously. The editors who drafted it are energy researchers from Princeton University, the University of Lund in Sweden, the congressional Office of Technology Assessment, and the International Energy Initiative in India. They have compiled the work of 48 world-class experts, who devote 1,000 pages to explicating the technical and economic prospects of a dozen forms of renewable energy. What's more, the book's assumptions about the potential of renewable energy in the United States are actually more conservative than projections made by the Department of Energy in 1990. Through careful, measured analysis, the researchers outline both the technological advances and the political measures needed to establish an energy system that uses renewable sources cleverly and efficiently.

A Tuber in Your Tank?

The editors foresee the transition to greater reliance on renewables unfolding in two stages. Sensibly, the first stage—

up to 2025—would involve greater use of technologies that are already cost-effective or nearly so, and that require only modest changes in equipment and energy infrastructure. Ethanol and methanol would power internal-combustion vehicles, requiring only slight alterations in engine design. These fuels can be produced from virtually any sort of biomass—crops, municipal solid waste such as newspapers, or agricultural and forestry waste. At the same time, more electricity would be generated using highly efficient gas turbines, similar to advanced jet engines, that would run on natural gas (a nonrenewable resource).

The exact nature of the second stage, from 2025 to 2050, would depend on technological and cost breakthroughs, and substantial investment in a range of new technologies. Nevertheless, the editors envision that in this stage most vehicles would be powered by fuel cells using methanol produced from biomass. Originally developed for space vehicles, fuel cells work much like batteries, converting the chemical energy of a fuel to direct-current electricity. The emissions of a fuel-cell vehicle—consisting of evaporated methanol—would be “orders of magnitude less” than for an internal-combustion vehicle.

Electricity in this second stage would be generated largely by a mix of “intermittent” renewables (those that work only when the sun shines or the wind blows) and gas turbines powered by gasified biomass instead of by natural gas, as in the first stage. Later still, natural gas might be partly displaced by hydrogen produced by solar-powered electrolysis of water and distributed through pipelines. In fact, devoting just 2 percent of the world's desert areas to photovoltaic hydrogen production (using modest amounts of water from rainfall or desalination plants) could yield as much energy as fossil fuels do now.

This flourishing of renewable energy technology is not likely to happen with the private sector acting alone. Although their cost is declining, renewables are not

expected to become less expensive than conventional energy. Thus, their development is unlikely to yield huge profits, and companies need some other incentive to bring these technologies to market quickly. The editors' answer: boost government research subsidies for renewables.

The U.S. government has long subsidized all forms of energy (some more than others) with tax incentives and research grants. The Department of Energy has estimated subsidies for fiscal 1992 at \$4.9 billion, of which renewables and conservation efforts together received 30 percent. But, the editors of *Renewable Energy* say, current subsidies are simply not enough to correct for imperfections in the market: because private firms receive no direct financial gain from reduced carbon-dioxide emissions, they will invest in renewable R&D below the socially optimal level. A government subsidy equal to the extra social benefits provided by renewables would remedy this source of economic inefficiency.

Because the citizens of most nations would benefit from a stabilized global climate, *Renewable Energy* advocates that the expense of subsidizing R&D be shared by many governments. Oil-importing nations, in particular, should be inclined to participate. A new argument made in the book is that a greatly expanded supply of renewables will foster a competitive market in energy, thus keeping the price of oil from rising above today's levels. Although the book does not make the case explicitly, nations that stand to benefit from stable oil prices would have a real economic incentive to subsidize renewable energy accordingly.

At the same time, unless an argument can be made that conventional energy is of value to society as a whole beyond its benefit to individual users, government subsidies for fossil fuels and nuclear power should end, says the book. Indeed, given the social costs of conventional energy, from air pollution to nuclear proliferation, economic efficiency dictates that subsi-

dies should be replaced with taxes.

A hidden danger is that as renewable energy becomes more competitive, oil exporters may be tempted to undercut the price of renewables to maintain their share of the market, imperiling the effort to slow climate change. The answer may be a carbon tax inversely proportional to the price of petroleum: the cheaper the oil, the higher the tax.

Of course, competitively priced renewables could pose problems of their own. Anticipating a boom in biomass production, the editors propose ways to maintain native forests and avoid displacing food crops with energy crops. Under their plan, biomass would be produced only on degraded lands in Latin America and sub-Saharan Africa, and on excess agricultural lands now set

aside in price-support programs in industrialized countries. But while this outcome is possible, it is not assured. If energy crops turn out to be highly profitable, for example, native forests will come under increasing pressure and might be preserved only through public purchase.

Getting Started

Although the editors don't go into detail about how to implement their scenario, it is not difficult to imagine ways in which governments can promote renewable energy. The first steps can be taken by individual nations. In the United States, the most promising renewable technologies could be targeted for support from existing federal R&D programs, including those admin-

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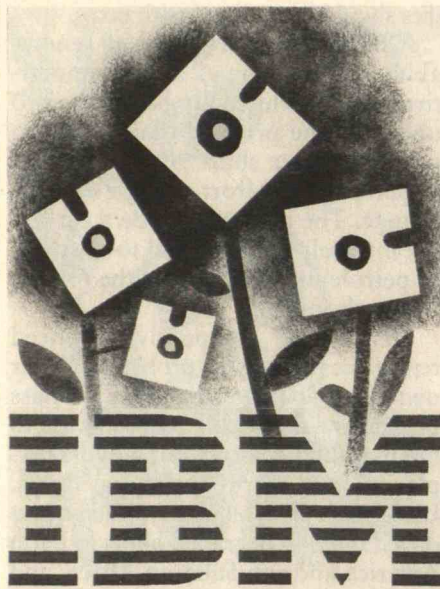
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istered by the Department of Energy, the Department of Commerce, and the Advanced Research Projects Agency. "Clean car" subsidies proposed by the Clinton administration could in part support research on fuel-cell vehicles. Agricultural policies could be reoriented to allow biomass production on fields now lying fallow under price-support programs.

But no nation can by itself stop climate change, and a global commitment to renewables seems crucial. Vice-President Al Gore, whose book *Earth in the Balance* warns that climate change may jeopardize global food security, is a natural choice for orchestrating concerted action. In his book, Gore proposed a globally funded Strategic Environment Initiative that would subsidize the development of renewables. The editors of *Renewable Energy* likewise suggest such an initiative, perhaps modeled after the International Rice Research Institute, which develops high-yield rice strains for use in many countries. Germany and Japan, which already fund domestic development of photovoltaics, might be among the first to underwrite a renewables institute. This institute could award research grants worldwide aimed at, say, designing a fuel cell that meets specified standards for weight, efficiency, and materials cost. Once developed, renewable technologies will spread more quickly with a global commitment to a carbon tax—as well as a uranium tax—to reflect the environmental costs of conventional fuels.

Ultimately, support for such initiatives depends on a public educated about the promise of renewable technologies for limiting climate change, stabilizing energy costs, and providing cleaner air. *Renewable Energy* can serve as the encyclopedia for that educational process until demonstration projects show more of these technologies in action. ■

WILLIAM L. DRISCOLL is an associate with ICF Inc., a multidisciplinary environmental consulting firm based in Fairfax, Virginia.



BOOKS

THERE IS LIFE AFTER BIG BLUE

Computer Wars: How the West Can Win in a Post-IBM World

By Charles H. Ferguson and Charles R. Morris
Times Books, \$23

BY LORI VALIGRA

It's hard to escape the irony: the greatest fall in the U.S. computer industry—that of IBM Corp.—has turned even some of the staunchest doomsayers into optimists.

Only a few years ago, Charles H. Ferguson, a Boston-based technology consultant, warned Washington politicians and corporate executives that the U.S. computer industry's lead was under siege from Japan's fast rise in manufacturing and process technology. Now Ferguson has changed his tune. In *Computer Wars: How the West Can Win in a Post-IBM World*, he and fellow technology consultant Charles R. Morris

conclude that manufacturing prowess alone will not be enough for Japan to dominate the computer industry. What's more, they write, IBM's recent retrenchment will allow entrepreneurial Silicon Valley firms to emerge as a key competitive force.

Far from being a sign of Japan's ascendancy in computing, say Ferguson and Morris, IBM's decline was inflicted by its own leaders. The authors complain that company managers were late to understand fundamental changes in the industry, often changes IBM itself had initiated. Added to that was an ever-growing bureaucracy and arrogance that dulled the company's competitive edge.

The most critical mistake came with the PC. IBM's stamp of approval on personal computers with its own product in 1981 wildly popularized the technology and made the PC the de facto industry standard. In 1982, *Time* magazine picked the IBM personal computer as its "Man of the Year" cover story.

IBM initially held a 50 percent share of the personal computer market, but Ferguson and Morris show how the company frittered away its lead by giving control of two key technologies to outsiders: microprocessors to Intel Corp., and the source code for the DOS operating system to Microsoft Corp., subsequently making chairman William Gates one of the richest people in America. IBM's share of the market is now less than 10 percent. "That the industry which it created and failed to control, the IBM-compatible PC, still bears IBM's name is a constant mockery," say the authors, who assert that IBM may be finished as a force in the industry.

Yet it is precisely the companies that fed off IBM and the new industries it spawned that can ensure continued U.S. strength in the computer industry. The authors pin their hopes on the "Silicon Valley model," with its intense, workaholic drive to create innovative products. "To date, America is the only country that has mastered it," they write. An old truth still prevails: Japanese companies can readily mimic and improve products

by refining processes and trimming manufacturing costs, but when it comes to innovating, they are far behind U.S. firms. Almost all microprocessor and software design rests in the hands of U.S. makers; most Japanese personal computers, for example, use U.S.-made microprocessors.

The innovative capacity of U.S. firms will give them the upper hand in what Ferguson and Morris regard as the critical competitive battle for technological leadership in the 1990s: the struggle for control of proprietary architectures—design standards that are set and controlled by private companies. But to exploit their advantage, U.S. firms need to follow the example set by IBM in its glory days. As the authors point out, the company was at its strongest when it kept control over markets it originated, such as that for IBM-compatible mainframes; it stayed ahead in technology, and its competitors could only hope to play follow-the-leader. Microchip maker Intel, software producer Microsoft, network firm Novell, and engineering-workstation company Sun Microsystems are among those that Ferguson and Morris deem well equipped to produce the world-standard architectures of the future. Such companies license innovative products cheaply so other manufacturers will adopt them, and then nimbly move on to the next version to stay in front.

Japan is weak at this game. When Japanese companies develop proprietary architectures, they are reluctant to share—a tendency that led to Sony Corp.'s well-known fiasco with the beta-format videocassette recorder. Sony developed what many video buffs consider a superior VCR standard but would not license it to competitors. Its Japanese rivals then banded together to create VHS, the standard that has virtually wiped beta off the map.

Ferguson and Morris make a strong case that America must prevail in, or at least not lose, the computer wars: leadership in the \$200 billion annual global computer market is fundamental to the nation's industrial health. If U.S. firms

make the most of their native strengths, say these authors, the United States can come out ahead in "the most competitive, swiftest moving, and hardest fought industrial battle in history." ■

LORI VALIGRA, a 1992–93 Knight science journalism fellow at MIT, spent five years writing about technology and business from Japan.

SOFTWARE

A GOOD MAP IS HARD TO FIND

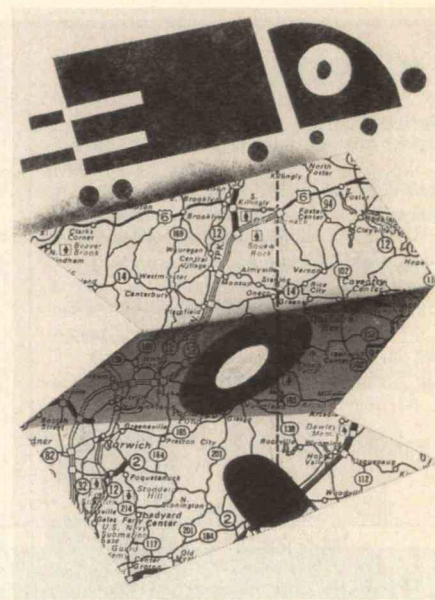
Automap—The Intelligent Road Atlas for Windows
Automap, Inc. (Phoenix, Ariz.), \$99.95

BY THOMAS SMITH

ONE night last year, I was making a delivery in the Williamsburg section of Brooklyn. I pulled my rig into the neighborhood in the middle of the night and began cruising the narrow streets, their shops shuttered with graffiti-covered gratings, in search of the correct address. The directions I had been given were deficient, and at 2 a.m. there was no one around I wanted to ask for help.

As a truck driver, I am constantly getting into such scrapes, so it was with more than passing interest that I agreed to try out Automap for Windows, a PC-based navigation aid. It promised to generate directions to anywhere in the United States, Canada, and northern Mexico, and print them neatly on a piece of paper with an accompanying map. Perhaps, I thought, the software would save me time, money, and headaches. Unfortunately, Automap is not complete enough or accurate enough for truckers, traveling salespeople, and others who make their living behind the wheel.

The use for which Automap is best suited is vacation planning. With in-



formation databases (which provide tourist-bureau phone numbers and other tidbits), topographical overlays, and a mileage guide that updates itself every time you alter the route, it is easy to try out different vacation destinations. Route preferences can be changed for each leg of the journey. For example, you can ask to explore some of the smaller towns in Kentucky but speed through Ohio. And if you are not certain where a place is, Automap will help you find it.

As a professional driver, however, I was most interested in the time, route, and distance functions. It is important for truckers to be punctual, and because a semi and trailer averages only about 6 miles per gallon, the shortest route is usually the best. There are exceptions, of course: when the road is narrow or slow, or passes through a great number of towns. (Generally speaking, two small towns is pleasant, three is a bore.)

By itself, Automap cares not a whit if it takes you through one small town or a hundred in pursuit of the shortest route. When I requested the *quickest* route from Boston to Albany, N.Y., the program correctly suggested I take Interstate 90 west. However, when asked for the *shortest* route for the same journey, it

Route: Boston, MA to Albany, NY
Quickest: 180 miles, 3 hours 26 minutes

Time	Instruction	Road	Dist.	Dir.	Towards
00:00	DEPART Boston (MA)	S9	10 miles	SW	Worcester
00:11	At Newton stay on the	S9	16 miles	SW	Worcester
00:30	At Framingham turn left	I90	68 miles	W	Chicopee
01:49	At Chicopee stay on the	I90	39 miles	W	Westfield
02:32	At Lee stay on	I90	4 miles	W	(Stockbridge)
02:36	At Stockbridge stay on	I90	44 miles	W	(Chatham)
03:26	ARRIVE Albany (NY)				

Route: Boston, MA to Albany, NY
Shortest: 175 miles, 3 hours 29 minutes

Time	Instruction	Road	Dist.	Dir.	Towards
00:00	DEPART Boston (MA)	U3	4 miles	W	Cambridge
00:06	At Cambridge stay on the	U3	3 miles	N	(Arlington)
00:11	Turn left onto	S2	17 miles	W	Fitchburg
00:33	At Maynard stay on the	S2	32 miles	W	Fitchburg
01:08	At Gardner stay on the	S2	10 miles	W	
01:19	Go onto	U202	9 miles	W	Holyoke
01:30	At Athol bear right onto	S2	13 miles	W	(Millers Falls)
01:44	At Millers Falls stay on	S2	4 miles	N	(Turners Falls)
01:49	At Turners Falls stay on	S2	3 miles	W	
01:51	Bear left onto	I91	4 miles	S	Springfield
01:55	At Greenfield turn off on	S2	32 miles	W	(N Adams)
02:34	At N Adams stay on the	S2	7 miles	W	(Williamstown)
02:42	At Williamstown turn left	U7	2 miles	SW	Pittsfield
02:44	Turn right onto	S2	27 miles	N	
03:17	Go onto	S7	2 miles	W	Schenectady
03:19	At Troy stay on the	S7	2 miles	W	Schenectady
03:22	Turn left onto	I787	7 miles	S	Albany
03:29	ARRIVE Albany (NY)				

Automap will get you there, but not necessarily on time. Hidden stumbling blocks make the "shortest" route (lower left) far slower than the printout suggests.

mountains with a few rather serious hairpin turns—by no means a pleasant trip in a truck. Although motorists might enjoy the scenic drive through the Berkshire hills and picturesque places like Williamstown, even in a car it won't be possible to keep Automap's time schedule.

A worse deficiency—affecting casual motorists and professional drivers alike—is the software's lack of cartographical data for cities. Austin, Tex., appears to be a dot at a crossroads; Washington, D.C., has perhaps four roads, none leading anywhere in particular. The designers clearly did not intend to provide this sort of information, but frankly it is just the sort that most drivers need.

Another drawback is that Automap is only as portable as the Windows software through which it must operate. While high-end laptop computers may have the capacity to run both Windows and Automap (which requires 5 megabytes of hard drive space and 2 megabytes of RAM), most computer owners will have to use the software at home, where it is least useful. In either case, a color monitor is necessary or else the whole country becomes an undifferentiated amber-colored spider web.

For the vacationer, casual traveler, or geography student, Automap might lead to hours of dreaming about life on the road without actually having to endure it. As for me, the *Trucker's Road Atlas* is still what I reach for. It has maps of cities, indicates weigh station and low bridges, and, most important, lists a few decent places to eat. ■

THOMAS SMITH, owner and president of New England Specialized Carriers, Inc., in Gloucester, Mass., has logged some 850,000 miles over his 10 years as a truck driver.

suggested Route 2, in the northern part of the state. Tantalizingly, Automap shows a difference of five miles between the two routes and a time difference of only three minutes. (See the printouts above.) Someone in my business looking at this information might think it prudent to take the shortest route; five fewer

miles could save fuel, and by avoiding I-90 (a toll highway), a driver of a tractor-trailer with five axles would save \$17.15 in Massachusetts alone.

But it just isn't reality. Route 2 is a mixture of every sort of road. Some parts are divided highway, others crawl through towns, and still others traverse

vary widely. But even one cheap program disproves Joskow and Marron's conclusion that efficiency must be costly. What's more, rigorous evaluations demonstrate cheap electrical savings in dozens of utilities' programs. The rest should emulate them—and do. Many utilities' profits now depend directly on how much and how cheaply they can prove they saved energy. Alert utility managers, regulators, and intervenors stop or reform programs that aren't cost-effective.

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TEAMWORK IN THE STEEL INDUSTRY

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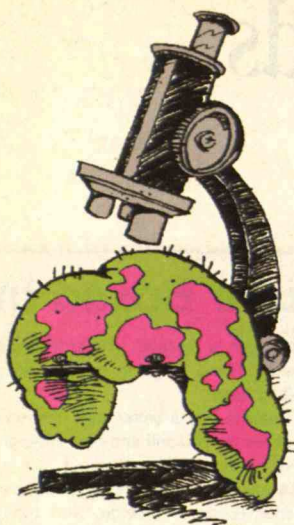
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Notes



Giant Germs

While routinely classifying the stomach contents of local wildlife back in 1985, a group of Israeli biologists recovered from a surgeonfish an odd-looking single-celled organism that researchers at Indiana University have recently concluded is the largest known bacterium. Measuring one-fiftieth of an inch, or about half the size of a hyphen, these cigar-shaped cells are more than one million times bigger than the average bacterium.

Scientists previously thought that bacteria this large could not exist because they would have no system of moving metabolites rapidly enough to and from all sites of cellular activity.

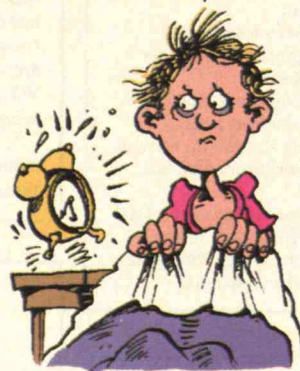
But electron microscopy revealed that the bacterium, called *Epulopiscium*, which means "guest at a banquet of a fish," is supported by a vast network of tubular membranes. IU graduate student Esther Angert says that these structures may contain transporter proteins, commonly found on internal membranes of larger organisms, to speed the flow of food to a digestive site or help move waste out of the cell.

Because this bacterium is so immense, Angert and her colleagues think they can more easily test these and other theories. For instance, it may be possible for the first time to insert microelectrodes right inside a bacterium to measure its electrical activity. "Such

studies," she says, "may help us better understand bacterial processes so we might be able to develop more effective antibiotics."

Sleeping Until the Crack of Noon

Many of us would probably brush off a teenager's desire to stay up late as an adolescent attempt to resist parental control. But a new study by researchers at Brown University suggests that biological changes associated with the onset of puberty may be the real cause of the behavior. A survey of about 500 sixth-grade students revealed a correlation between pubescent changes, such as facial-hair growth in boys and menstruation in girls, and a propensity for being more active later in the day.



Study director Mary Carskadon speculates that melatonin, a light-sensitive hormone, could be responsible, since it may be involved in regulating both daily rhythms and reproductive cycles. In certain animals, the hormone alerts the brain to seasonal changes by its response to changes in the period of daylight. For example, a melatonin signal that spring is imminent means that conditions are favorable for reproduction and that activities may be extended a little longer each day. Similarly, during human puberty, melatonin has

been implicated as a signal to prepare the body for reproduction. But the message to extend the day may be getting passed on as well.

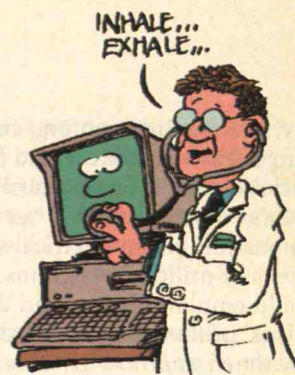
If substantiated, the findings may have implications for the timing of the school day, says Carskadon. "The practice of ringing the opening bell earlier in high school than in junior high, and earlier in junior high than in elementary school, may run precisely counter to children's biological needs."

Parents Who Smoke Need Not Apply

Would-be parents who smoke take note. British adoption agencies in conjunction with the UK Department of Health have released guidelines banning smokers from adopting young children, according to the *Addiction Research Foundation Journal*. The British Agencies for Adoption and Fostering (BAAF), an umbrella group, says there is overwhelming evidence that children younger than two and those with respiratory illnesses are at particular risk from passive smoking. Marion Miles, head of the BAAF's medical committee, says that infants run twice the risk of crib death when mothers smoke up to nine cigarettes a day, asthmatic children in homes with smokers have nearly 50 percent more symptoms, and children with smoking parents run an increased risk of bronchitis and pneumonia.

Breathe When You Say That

If you've ever listened to computer-synthesized speech, you know that making sense of its unnatural style requires some effort. Now researchers believe speech synthesizers would be more intelligible if they made



breathing sounds while talking.

To prove the theory, Douglas Whalen, a researcher at Haskins Laboratories, a private speech center in New Haven, Conn., asked subjects to listen to selections of synthesized speech and write down what they thought the computer was saying. For one group, Whalen played two sets of computer-spoken sentences: the first contained conventional synthesized speech, while the second set included a breath sound before each sentence. The speech containing breath sounds, Whalen observed, was much easier to understand.

To verify that the effect was not simply due to the fact that comprehension normally improves as listeners become accustomed to new speech rhythms, inflections, and pronunciations, Whalen played the selections in reverse order for another group. He found that comprehension of the speech with breath sounds included, though played first, was still significantly better.

Whalen and his colleagues hope to improve comprehension further by mimicking other subtleties of human speech. For example, he suggests that incorporating breathing sounds in computer speech whenever a person might normally pause to inhale, not just at the beginning of each sentence, may help make synthetic speech sound more natural. And varying the duration of the breath intake may help indicate the length of the phrase, sentence, or thought to follow.

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